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T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.
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CONTENTS.

ILLUSTRATED ARTICLES: PAGE.

Accumulators versus Direct Current for Electric Traction ... 240
The Short Electric Railway at Columbus, O. ... 241
The Elongation and Contraction of Metals in Magnetic Fields ... 242
Instrument for Testing Telephone Transmitters and Induction Coils ... 242
Preserving Dynamo Brushes (Corr) ... 242
A Novel Dynamo and Accessories ... 243
An Improved Watchman's Time Detector ... 244
A Small Self-Regulating Dynamo ... 244
The Carbondale (Pa.) Electric Road ... 244

NEW BOOKS:
"American Street Railways." ... 240

CORRESPONDENCE:
Primary Battery Lighting .. 242
Built-Up Dynamo Plants ... 242
Preserving Dynamo Brushes 242
Carbon as a Positive Element ... 242
Magnets with Consequent Poles ... 242
Wiring Houses for Different Systems ... 242

EDITORIAL: PAGE.

Paragraphs ... 239

MISCELLANEOUS:

The Death of Sir Charles Bright ... 240
Formulas for Wiring ... 241
The National Electric Light Association ... 242
Co-Operation Among Telegraphers ... 243
The American Institute of Electrical Engineers. ... 244
A New Electric Motor for Tram Cars ... 244
A New Current Meter ... 244

SPECIAL CORRESPONDENCE:

New York Notes ... 245
New England Notes ... 245
Philadelphia Notes ... 246
Western Notes ... 246
English Notes ... 247

DEPARTMENTS:

The Telegraph ... 248
The Telephone ... 248
The Electric Light ... 249
Applications of Power ... 249
Miscellaneous Notes ... 249
Personals ... 249
Business Notices ... 249
Our Illustrated Record of Electrical Patents. ... 250

Electric Railways. No one can read the many items this week in our department of "Applications of Power" without perceiving that electric railways are to the fore as attractive enterprises. The increase in the number of electric railways this year extends all over the country.

Co-Operative Operators. A LITTLE article appearing elsewhere in our pages this week tells of the work done by American telegraphers in movements of a co-operative character, for life insurance, sick relief and the purchase of homes. The record is full of promise and encouragement to all who hold that on the application of co-operative principles a large part of the welfare of modern society depends.

Standards of Competency. THE desire of the National Electric Light Association to assist in the good work begun by the Boston Electric Exchange will, it seems likely, bear fruit before long. A committee has now been appointed on the subject and an interesting report may be expected at the convention to be held in August in this city. We hear that in New England the action already taken is productive of good in causing the men who do the construction work of electric light installations to seek to qualify themselves for licenses, and if nothing else had been gained than this, Mr. Alexander and his associates who set the ball rolling would be gratified and repaid. What is now wanted is like work everywhere, and, through the agency of the Association, a uniformity of rule and standard.

Wiring Houses in Advance. A CORRESPONDENT in another column makes inquiry on a point which, it seems to us, ought to command the serious attention of those engaged in wiring houses for incandescent lighting, when the quality of the lamp, and other conditions of operation, are as yet undetermined. There is practically so little difference between the current energy required by the lamps of different makers that the dimensions of the wires for these different plants would probably not vary greatly when lamps of like voltage or of nearly like voltage are employed. But we can conceive that cases might arise in which this difference would become considerable even to-day; so much so, as to affect the economy, if not the safety, of the installation. Leaving future methods of electric illumination out of consideration, it would seem, therefore, that the wiring of new buildings should not be undertaken until the conditions of working are well known. Or, given a certain method of wiring, the subsequent installation should be in exact conformity therewith.

Alternating vs. Continuous Currents. IN the fifth paper on this subject, read by Mr. George Cutter, before the Chicago Electric Club, the author states at once his absolute faith in the alternating current. He begins by questioning the accuracy of Mr. H. Ward Leonard's figures of the cost of current distribution on the three-wire system, and in one case obtains a figure double that of Mr. Leonard. As regards the danger from leakage of the converters, Mr. Cutter maintains that a leaky converter, if grounded, will only affect a few lamps, whereas a leak with the continuous current transformer and a network for low pressure local distribution would endanger all the lamps connected to the network. Mr. Cutter then compared the various systems of supply by direct currents, continuous current transformers, storage batteries, etc., and his conclusions were that none of them presented all the advantages of the alternating method, whether for lighting, power, or other applications of the current already known, or which may be developed in the future.

Wiring Tables for Electric Lighting. THE table for wiring houses, which we published in a recent issue, has brought to us a large number of letters from correspondents who desire to know if other rules are accurate which they give in their letters and which vary considerably from one another. Without going into a strict examination of these rules, which would occupy a good deal of time, we can say generally that in most of the cases they are specific rules which apply to particular cases, like the one which we published, and which we were careful to point out was of such a nature that it could not be applied generally. In the present issue we give space to a communication on this subject, which we believe expresses in a clear manner the true principle upon which all rules of this nature ought to be based. As pointed out in that article, the true principle rests merely on the application of Ohm's law and its corollaries. With this as a basis we may frame formulas which may apply to any number of specific cases, and if the principle involved be always borne in mind, the danger which such specific formula are liable to give rise to in the hands of the inexperienced will be avoided.

High Resistance Arc Light Carbons. A CORRESPONDENT has communicated to us an experience which may be of interest to some of our readers as showing the influence of the resistance of the arc carbon and the power required to operate arc lamps. He relates that having run a double arc lamp until one of the sets of carbons was burned out, the lamp failed to strike the arc with the other carbons, but instead of this the new set of carbons were continuously separated and brought together again by the action of the lamp. Being curious to find out the cause of this action, the works were closely examined, but nothing was found to be wrong at that point; when, accidentally touching the carbons during this operation our correspondent had his fingers scorched. This showed an abnormal development of heat in the carbons, which, by the way, were plain uncopperred. The reason for the non-action of the lamp and the heating of the carbons now became apparent, and upon taking them out and measuring their resistance it was found that the 12-inch $\frac{7}{16}$ carbon had no less a resistance than $4\frac{1}{2}$ ohms. The lower negative carbon, $5\frac{1}{2}$ inches long, had a resistance of $2\frac{9}{16}$ ohms. These carbons together presented as much resistance in the circuit as would two ordinary arc lamps, including the resistance of the arcs and regulating coils. The great increase in the power necessary to operate arc lamps with carbons of such high resistance will be apparent to all.

Primary Battery Lighting. A GREAT many reports appear in print, and a great many inquiries reach us, as to plans and inventions for electric lighting from primary batteries. At the present time two or three promoters are inviting public support for such enterprises. Now we would like to say that while in many of these instances the inventors and experimenters are honest and well-meaning, the odds are against them. With zinc costing twenty times as much as coal, it does not require much penetration for even one unfamiliar with electricity to see that all batteries consuming zinc have hard work to compete with steam or water power in generating current, but the great trouble is that many who are invited to invest do not stop to consider little facts like these. Of other types of batteries, we are personally acquainted with none that have yet solved the problems involved. We do not say that the goal will never be reached; on the contrary, we know of more than one hopeful line of investigation now being followed, and shall be only too glad to herald success. Meantime some of the schemes paraded before the public eye must be characterized as rank swindles. They need not be named. Any prudent man proposing to put his money into them can soon find out their true inwardness.

The American Institute of Electrical Engineers. AS noted on another page, the annual meeting of the Institute will be held next week. It promises to be of interest equal to that of any of its predecessors, and the subjects that will be brought up are such as to elicit lively and valuable discussion. The Institute is now about to enter upon its fifth year, and, by natural growth, is, we are glad to believe, in a better condition to meet its responsibilities as a scientific body than it has ever been before. It has not yet realized every one of its worthy ambitions, even some that have been entertained for years, but in all work that lies nearest to its true mission and most thoroughly exemplifies its purpose, it is increasingly successful and useful. Slowly, but surely, the Institute is reaching the full measure of its opportunities, and in its cultivation of the field of electrical inquiry and investigation, it now enjoys the help at home and throughout the country of many kindred bodies, between whom and itself there will be, we hope, as time passes on, more and more intimacy and intercourse. The vitality of such a society as the Institute depends not only upon the numerical strength of its members but also upon their pride in an honorable profession on which its high standing as their representative must ever have a most beneficial effect. The laudable spirit which has built up the Societies of Civil Engineers and Mechanical Engineers, now so influential and prosperous, dwells also, we think, among the Electrical Engineers, who have watched their own organization advancing at no less rate in all elements of usefulness, and who see it meet with hearty esteem and commendation on all sides. Those who have still to carry on the Institute's work, and who will fill its offices in the coming year, have much to do, and they should be assisted and stimulated by that frank and cordial support, than which no greater incentive to faithful discharge of public duty can be found.

Royal Ideas on Electricity. IT is hardly to be expected that any one not making a study of the science of electricity should have clear ideas on the subject; but observers will have noticed that laymen, as a rule, try to explain and grasp the phenomena by analogies most familiar to them and drawn directly from their daily occupations. This is well exemplified in the ideas which the late Emperor of Germany had formed on the subject of electricity. Being eminently a soldier, he may be said to have regarded the subject solely from the military standpoint, and in a recent eulogistic address before the Berlin Elektrotechnische Verein, Dr. von Stephan, Minister of Posts and Telegraphs, related several instances of the manner in which he attempted to convey electrical conceptions to the mind of the Emperor. Thus on one occasion, the Emperor asked how the term "battery" came to be chosen, which, by the way, he preferred to the word "pile," on account of the latter's French origin. The speaker sought to explain the origin of the word by a method most easily comprehended by the Emperor, and referred to the analogy between the military battery and the observed power of the electric battery to deliver blows or shocks under certain circumstances; whereupon the emperor suggested the idea that in the future it might come to pass that nations would carry on warfare solely with machines which would be driven up against one another, which method would in the end prevent the spilling of much blood. Naturally the field and military telegraph aroused the special interest of the emperor, and when upon a certain occasion reference was made to the great rapidity with which he had massed and mobilized his troops during his later wars, he observed naïvely that the older great commanders would have been able to have done the same thing if they had had the telegraph at their command.

NEW BOOKS.

AMERICAN STREET RAILWAYS: Construction, Equipment and Maintenance. By Augustine D. Wright. Chicago. Rand, McNally & Co. 200 pages. 8vo. Illustrated. Price $5.

This excellent work, like so many other of our best technical books, is a compilation of articles that have already appeared in a technical journal. Mr. Wright's contributions were made originally to the *Street Railway Gazette*, and he has now gathered them together in such a shape that they present a very handy and valuable treatise on the construction, equipment and maintenance of street railways. The book is, if we are not mistaken, the first monograph of the kind to appear in this country from the pen of an American writer, and as American practice differs so radically from that which prevails abroad, it is evident at once that the work is specially useful, not only for those who have to deal daily with the difficulties in this country, but for those in other countries who wish to derive lessons from our methods here. Mr. Wright does not go into the question of cable and electric roads as opposed to horse roads, but the chapters of his book which touch upon track construction, paving, track cleaning, the building of cars and the arrangement of stations or stables, will be found of use for all systems. Every page is stamped with authority as coming from a leading expert who has made a specialty of the subject, and who writes out in plain language the result of many years of solid experience and careful experiment. A very valuable appendix is given, containing the paper read by Mr. Wright before the Western Society of Engineers, three years ago, on the amount of horse power used in propelling street cars. It is a very interesting analysis of the question, and brings out a great many results of importance which should be studied, by those especially who are devoting their energies to the introduction of electric railways. It is interesting to find, for example, that on the Boston street railroads with 6,158 horses the average daily distance traveled by the horses was only 10.04 miles. It also comes out that on the North Chicago street railway the average daily service of the horses was just 188 minutes. With these figures before us it is easy to understand why the Broadway road in this city requires 12 horses per car, and it is not so easy to understand why an electric motor, say of 10 h. p., should be expected to run 24 hours a day, every day of the week, developing 15 h. p. the best part of the time, and showing up in finer shape all the while. We can heartily recommend this book to all who are interested in electric railways, and may express the belief that when the next edition comes out electricity will furnish a leading part of its contents. It is stated by Mr. Wright, by the way, that in January, 1887, there were 4,864 miles of street railway in this country, upon which 20,392 cars were drawn and 98,659 horses were employed, besides cables, electric motors, etc. The statistics, which, as we have occasion to know, are very near the mark, show the vast importance of this field of operation, now so greatly on the increase, and that presents so many opportunities for electrical engineering skill.

Accumulators versus Direct Current for Electric Traction.

BY R. M. HUNTER, M. E.

Under the above heading there appeared in this journal in the issue of April 14 an article by W. Lineff, as an abstract from the *Proc. Inst. Civil Engineers*, London, which article at a single glance shows that the writer was opposed to electrical accumulators for traction purposes, and in my opinion many of his statements are incorrect, and liable to mislead those who are not fully informed.

He compares the overhead system, the conduit system and the electrical accumulator system, with the clear statement that "he will leave out of the calculation all expenses relating to permanent way, generating plant, etc." I will simply refer to the comparisons between the first and last of the above systems, as showing the *greatest difference against* accumulators, and to simplify my objection, I will take his figures of the overhead system as costing £200 per mile as a basis, and in doing so I will also use his assumption as to the E. M. F. and current necessary, viz., 250 volts and 30 ampères for the two cars, which would give him $250 \times 30 = 7{,}500$ watts for the two cars, or approximately 5 h. p. per car. This would not suffice for anything but a level road and lightly loaded cars, for otherwise he could not start the car after stopping. This, then, must also be the basis of the power of the accumulator cars.

I would note, however, that he assumes the cost per mile to be £200, and as he has two cars I presume he proposes to have a return track or at least turn-outs and switches. If the former, then the cost would be twice his estimate, or £400, and if the latter, he would have to allow in the neighborhood of £10 for the additional mechanism required. To give him all the advantages, I will say that the cost is to be £210. The electrical accumulators required are only two sets, and not three sets as he assumes, and for a capacity of 5 h. p. per car over such a track as proposed, 27 cells will suffice. Thus with two sets we would require 54 cells per car, or 108 cells all told for the two cars, which, charged for at the rate he gives, viz., £60 per ton, would give 2 tons, costing £120. Next, he assumes that the increase of cost for cars, motors, etc., is 50 per cent. of the £120, which is really absurd. Practice in building such cars has shown us that the additional cost is only trifling, and this would be particularly so, where only 27 cells were used per car. An increase of £20 would be ample.

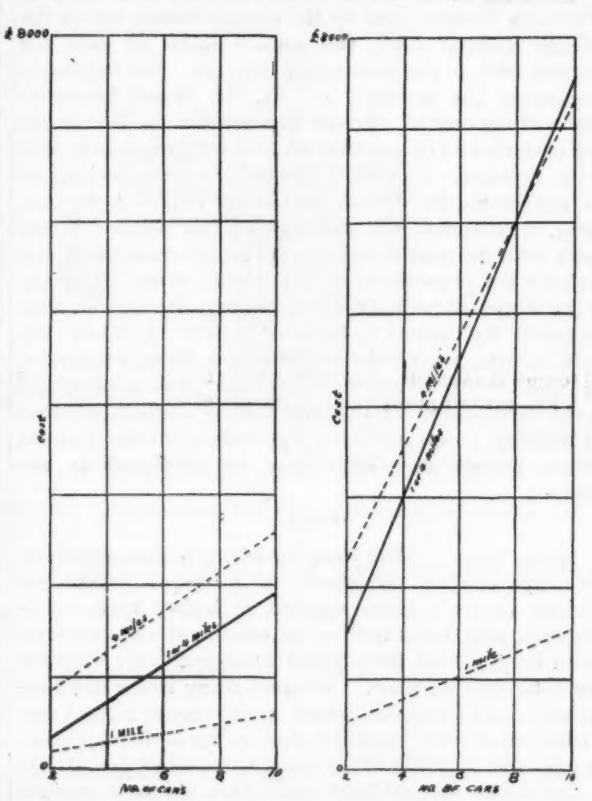
Now comparing these figures we will have a correct idea of the relative costs, with Mr. Lineff's general assumptions.

Cost per mile, line conductor system	£210
Cost of electrical accumulator system	160

Now, these figures will be criticised as ridiculous, no doubt, but they are based on Mr. Lineff's assumption as to cost of batteries. We use, in round numbers, 80 cells per car, and this gives us in emergencies about 20 electrical horse power, and if we use the guaranteed capacity of the batteries for general work we will then have 10 h. p. Now, to avoid all question, I will assume that 40 cells per car are required in place of 27, and furthermore that the cost is £113.33 per ton, or nearly twice Mr. Lineff's figures; then we will have £340 for batteries, plus £20 allowance each for additional cost of cars, etc., making a total of £380. With my liberal additions to Mr. Lineff's figures, we would have:

Cost per mile, line conductor system	£210
Cost of electrical accumulator system	380

The next point is the depreciation, and his method of arriving at it is ambiguous and inconsistent with his first proposition. Taking a 10 per cent. depreciation on the line conductor system, we have total cost of £251, and a 30 per cent. depreciation on the battery system, we have a total cost of £380 + £114 = £494 for the first year; and each subsequent year it will be in favor of the accumulator system until after the line conductors have been replaced. Mr.



COMPARATIVE COST OF ELECTRIC RAILWAY SYSTEMS.

Lineff, in computing the cost of these systems, does not charge anything against the line system for the £21 depreciation, but does multiply the actual cost as he makes it in the case of the accumulator system, by 3. This is absurd. To provide for the 10 per cent. depreciation in the first year, and say 50 per cent. depreciation for the fifth year, when the line conductor would have to be renewed, we would have an average depreciation of about 18 per cent. on the £210, or about £37, making the cost of the line system £247, and requiring a 10 per cent. investment to meet this depreciation of £37, that is, £370.

On the other hand, the accumulator system has a depreciation of a regular 30 per cent., equaling £114, or requiring a 10 per cent. investment of £1,140, making a *total outlay for plant and investment for depreciation* as follows:

Line conductor system	£580
Accumulator system	1,520

This is very different from the figures £200 to £2,400 given by Mr. Lineff.

The next point to be considered is the fact that Mr. Lineff in increasing the number of miles simply proportionally increases the first cost of conductor without any reference to the additional depreciation, loss of current, etc.; but where he falls into his greatest error is when he increases his car service, for here he has the same *one mile single track* with 10 cars on it and no provision for turn-outs. How ten cars would operate both ways under those conditions on a one mile track I do not understand, but it is about on a par with the rest of the deductions.

Now let us look at the one mile problem with ten cars. It would unquestionably have to be a *double* line, hence first cost of line conductor system would be £550, as the additional service and line resistance requires larger conductors. This, with depreciation and investment as above, would equal £1,540; and there would be no increase in the accumulator system except five times the cost, which would equal £7,600; and not £800 to £12,000 as he makes out.

Considering the same two extremes with the four mile railway, we have for two cars, first cost:

Line conductor system	£810
Accumulator system	380

And with the interest investment for depreciation:

Line conductor system	£2,268
Accumulator system	1,520

And on the four mile railway with 10 cars we would have as the result for first cost:

Line conductor system	£2,600
Accumulator system	1,900

For we require a double track and line conductors and provision for increased resistance. With interest investment added we have:

Line conductor system	£7,280
Accumulator system	7,600

Now, putting these figures into two tables, we have:

TABLE I.

FIRST COST.

System,	1 mile.		4 miles.	
	2 cars.	10 cars.	2 cars.	10 cars.
Line conductor system	£210	£550	£810	£2,600
Accumulator system	380	1,900	380	1,900

TABLE II.

TOTAL COST WITH INVESTMENT MONEY FOR DEPRECIATION.

System.	1 mile.		4 miles.	
	2 cars.	10 cars.	2 cars.	10 cars.
Line conductor system	£580	£1,540	£2,268	£7,280
Accumulator system	1,520	7,600	1,520	7,600

These tables are unbiased, for the company I represent, the Electric Car Company of America, is as much interested in line conductor systems as in the electrical accumulator system. These figures show one fact conclusively, which is borne out in practice, and that is, that for a few cars on a long line the electrical accumulator system is the most economical as to cost of equipment, but where a large number of cars are used, the central station supply or direct system is the cheapest; but it can only be put in our large cities by means of the expensive conduits, which make it nearer equal to the cost of the accumulator system on large roads in densely populated districts where many cars are run.

The electrical accumulator system offers exceptional advantages on account of its ready adaptation to roads already laid.

The results of the foregoing tables are graphically shown in the accompanying diagrams. The dotted lines indicate the line conductor system, and the diagonal full lines the electrical accummulator system, and they show the variation in cost. If we ignore the difference in depreciation, then it will be seen that to operate 10 cars on 4 miles is cheaper with accumulators than with line conductors; but owing to the greater depreciation in the accumulator system (with accumulators as now made) when we get above 8 cars on a 4-mile track the line conductor becomes cheapest. There are, however, many other points besides cheapness of construction which could be considered, but which need not be discussed here.

The Death of Sir Charles Bright.

The death is announced in a cable dispatch of Sir Charles Tilston Bright, Knt., F. R. A. S., F. R. G. S., one of the projectors of the first transatlantic cable, and who has since been prominently identified with the extension of submarine telegraphs throughout the world. He was born in 1832, commenced the active business of his profession in 1852, and in 1853, as engineer to the English and Irish Magnetic Telegraph Company, was immediately concerned in the union of Great Britain with Ireland by submarine telegraph. In 1856 he was one of four original projectors of a line of telegraph between the west coast of Ireland and America, which work, as engineer to the Atlantic Telegraph Company, he accomplished in August, 1858, when he received the honor of knighthood. Several messages were transmitted between London and New York and other places, among them congratulatory addresses between the Queen and the President of the United States, and orders countermanding the dispatch of two regiments from Canada to India, by which the country saved upward of £50,000. The line, however, ceased to work a few weeks afterward. Sir C. Bright was returned for Greenwich at the general election of 1865, and sat in Parliament until 1868, when his seat was transferred to Mr. Gladstone, and he gave himself up again to the promotion of cable enterprises, such as the Eastern Telegraph Company, the West India and Panama Company, and others. In 1881 he was one of the English Commissioners to the French Electrical Exhibition, and in 1887 he was the President of the Society of Telegraph

Engineers and Electricians. He was a member of various learned societies, and received many honors, including the Telford gold medal in 1864.

The Short Electric Railway at Columbus, O.

During the fall and winter just past active work has been going on in the construction of the electric railway at Columbus, Ohio, equipped on the series system of Mr. Sidney H. Short. In this series system, it will be remembered, the current passes continuously through the motor on each car, in contradistinction to the multiple arc system, in which the motors are connected directly across the line.

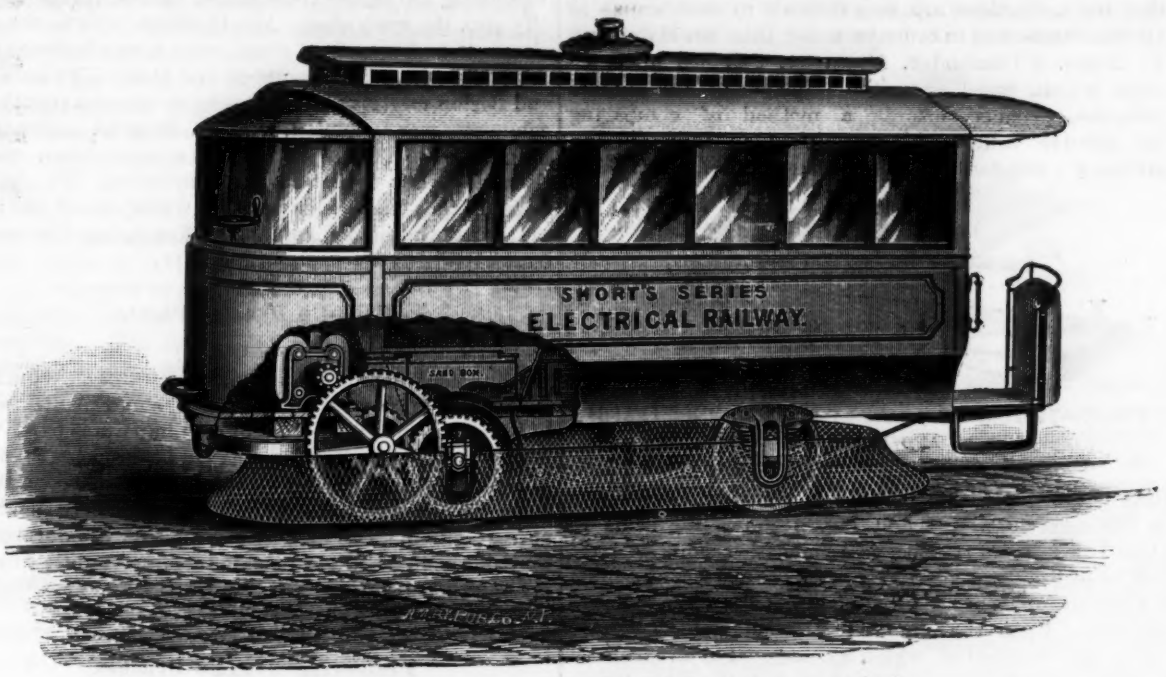


FIG. 1.—CAR ON SHORT'S ELECTRIC ROAD.

The accompanying illustration, Fig. 1, shows the car employed and the Brush motor, which is placed on the front platform. The cars are quite large, being 27 feet in length and calculated to hold 100 passengers. The arrangements employed for supporting the conductors, which are only ¼ inch in diameter, are shown in Figs. 2 and 3, which show respectively the overhead and the conduit system. A large steam plant, with Brush dynamos, is being erected at Columbus to provide for the extension of the electric railroad, which will be required to haul a large number of passengers to the Ohio Valley Centennial Exhibition grounds.

Formulas for Wiring.

BY ELMER E. E. EMMONS.

Mr. Crockett's diagram for incandescent wiring appearing in THE ELECTRICAL WORLD of April 21, although good in its way and saving a large amount of work in calculating, is only a partial solution of the problem. The diagram, as it was remarked in an editorial of the same issue, is only useful under certain conditions, viz., in systems of two or three wires, having the potential and current given with the diagram; for all others it is useless.

Every central station should have diagrams for each system it uses, each diagram to be used only on that system for which it is constructed.

If such a diagram is properly made and the men instructed in its use, it will be the means of saving considerable time and securing accuracy.

But in the general application of electricity, the factors, current and potential, are variable to such an extent that it would be impossible to have a diagram to meet all wants. To men having to do wiring such a variety of conditions are sure to present themselves, and what is really needed is a formula that will fit any case, be it lamps or motors to be supplied, it being immaterial whether the current is taken from dynamo or battery.

I find that most men who have had no experience in mathematics beyond the common arithmetic, have a holy horror of anything that resembles an algebraical formula, and, however simple, pass it quickly by.

Now, an algebraic formula is only a rule concisely stated, an idea which they entirely fail to grasp. The same men would read a rule in arithmetic and do an example by it, but when that same rule is presented in the shape of a combination of letters, they immediately turn their backs to it. Any man having a common school education can readily work out any formula that may be given for wiring, and if he knows the reasons for its structure, will the more readily comprehend and use the same. Such a formula can easily be deduced from Ohm's law, may easily be committed to memory, and will be found invaluable, not only in determining the size of wire, but in finding the percentage of loss in that already in place.

Ohm's law reads thus: $C = \frac{E}{R}$; that is, the current flowing in any circuit is equal to the electromotive force of the battery or dynamo divided by the resistance of the whole circuit, *i. e.*, of the battery or dynamo and outside circuit combined.

Now the E. M. F. is the whole force tending to drive the current through the entire circuit; but part of that force is used in driving the current through the resistance of the battery or dynamo; the remainder being found at the poles and used in forcing the current through the outside circuit. That balance of pressure at the poles is called the *difference of potential, and is just sufficient to send the current through the external circuit.*

Let C stand for current, R for the resistance of the wire, and P for the difference of potential at the ends of the wire. Ohm's law will then read: $C = \frac{P}{R}$; that is, the current in any wire is equal to the difference of potential at its ends divided by the resistance of the wire.

If $C = \frac{P}{R}$, then $C R = P$; that is, *the resistance of any wire, multiplied by the current flowing through it, is equal to the difference of potential at its ends.*

The resistance of one foot of pure copper wire, one thousandth of an inch in diameter, is equal to 9.94 ohms, and if the wire used has 95 per cent. of the conductivity of pure copper, its resistance will be equal to 10.46 ohms.

Let L equal the length of the wire to the lamps, or motor, and back. Then if one foot of wire one mil in diameter equals 10.46 ohms, a length of L feet will be equal to 10.46 L ohms. But the resistance of a wire varies as the cross-section, that is, the greater the section the less the resistance, or more accurately, it varies inversely as the cross-section. To use the cross-section in our formula would add to the work in calculating, because it is the diameter we are after.

We may now inquire into the relation between the cross-section and diameter.

Take the case of three wires, a, b and c having the respective diameters d, d_1, d_2. The cross-section of a will equal $\frac{\pi}{4} d^2$; that of b equals $\frac{\pi}{4} d_1^2$, and of c equals $\frac{\pi}{4} d_2^2$. π is the ratio of the circumference of a circle to its diameter.

From the above we see that $\frac{\pi}{4}$ is a constant, for the expression appears in each case; the only thing that varies is d^2.

We therefore conclude that the section varies directly as the square of the diameter, which will make the resistance vary *inversely* as the square of the diameter.

We may now write for the resistance of our wire of length L in feet: $R = \frac{10.46\ L}{D^2}$; D being the diameter of a wire expressed in thousandths of an inch or mils; and D^2 being consequently expressed in circular mils.

Now as the potential P, required to force the current C through a given resistance R, is equal to the product of the resistance and current, the potential lost in the wire of length L will equal $\frac{10.46\ L\ C}{D^2}$.

If P is the potential required to run the lamps or motor and N the percentage of P to be lost in the wire, the amount of potential or electric pressure lost will equal $P\ N$. As $P\ N$ is the potential to be lost in the wire, these two quantities must be equal to each other; that is, $P N = \frac{10.46\ L\ C}{D^2}$, and $P\ N\ D^2 = 10.46\ L\ C$.

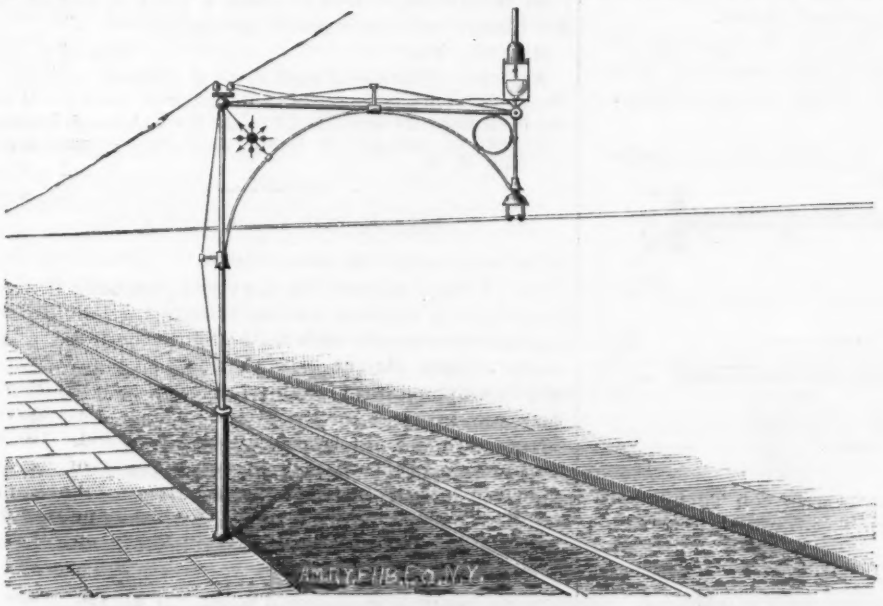
Therefore, $D^2 = \frac{10.46\ L\ C}{P\ N}$ and $D = \sqrt{\frac{10.46\ L\ C}{P\ N}}$.

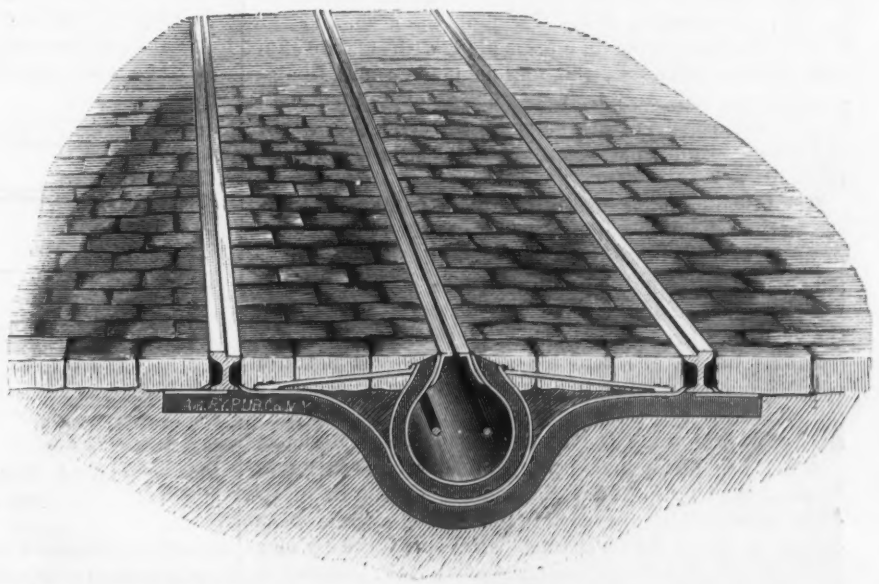
Tables containing the different sizes of wire and their diameters can be readily obtained of manufacturers, and as we now know the diameter, we can, by referring to the table, find the corresponding size.

Any one acquainted with the laws governing the flow of current may readily develop such a formula, and to show how short and clear the above formula is, we may write it as a rule in arithmetic would be written, as follows:

Multiply the resistance of 1 foot of wire .001 inch in diameter of the given material by its length in feet and by the current flowing through it; divide this number by the product of the potential required by the lamps or motor, and the percentage to be lost, and take the square root of the quotient; the result will be the required diameter. Any one on comparing the two will see that the formula is much easier and its meaning less liable to be misconstrued.

Sir William Thomson gives the following law for determining the percentage to be lost in the wire: In any system the greatest economy is attained when the cost of the energy lost in heating the wires equals the interest on the cost of the copper.



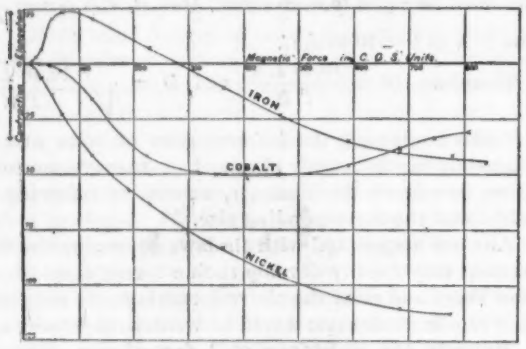


FIGS. 2 AND 3.—SHORT'S OVERHEAD AND UNDERGROUND ELECTRIC RAILWAY SYSTEM.

The Kiernan News Agency of this city has been re-incorporated as the Kiernan News Company, with the backing, it is said, of Drexel, Morgan & Co. Mr. W. E. Clapp is president, and Mr. C. F. Tracy is the managing director. Mr. Kiernan will be assistant manager under Mr. Ashley W. Cole.

The Elongation and Contraction of Metals in Magnetic Fields.

It has long been known that a bar of iron when magnetized by a surrounding solenoid alters its length, and with the weak magnetizing forces which were originally employed in these experiments, the alteration was invariably an increase in length. One of the earliest experimenters, and probably the original discoverer of this behavior of iron when magnetized, was Joule; but he invariably found that the length increases with the magnetizing force. In his experiments, however, the magnetizing force did not exceed 87 C.G.S. units, and an ingenious theory was propounded to show that elongation must take place when a bar of iron is magnetized. It was believed that the molecules as they rotate under the influence of the lines of force, and become more or less parallel, they naturally require more room in the direction of the length of the rod, and therefore cause the latter to extend with a corresponding decrease of diameter. This simple explanation was refuted by the experiments of Mr. Shelford Bidwell, which he made some years ago, and in a paper communicated by him to the Royal Society in 1885, he showed that the elongation does not remain unchanged at its maximum when the magnetizing force exceeds that which is sufficient to produce so-called saturation; but, on the contrary, that with increasing magnetizing forces beyond this limit the elongation becomes less until the rod, after returning to its original length, ultimately becomes actually shorter than it was in the unmagnetized condition. Mr. Shelford Bidwell has, however, recently contributed to the Royal Society another paper on the same subject, and in this he points out that his original investigations might be open to the following objections: (1) The field due to the magnetizing solenoid was not quite uniform; (2) the effect of the ends of the rods was uncertain, and might have played some material part in the production of the phenomena in question; (3) all the rods used in the experiments retained a certain amount of permanent magnetism. To meet these objections he has carried out a further series of experiments by using rings instead of rods of iron, and observing the changes of diameter. The rings were also demag-



ELONGATION AND CONTRACTION IN MAGNETIC FIELDS.

netized before every observation, and the battery employed was much stronger than that used in the first experiments, so as to produce very great magnetizing forces. He found that in their general character the phenomena of elongation and contraction were the same with rings as with straight bars, thus proving that the effect of magnetization was independent of the form of the iron, and as it was much easier to obtain intense fields with straight than with circular solenoids, the author made some further experiments with straight rods. These experiments embraced iron, cobalt, nickel, manganese steel, and bismuth, and the highest magnetizing force reached was 840 C. G. S. units.

The accompanying diagram, taken from *Industries*, shows the behavior of iron, cobalt and nickel in magnetic fields of varying intensity. The strength of field is plotted on the horizontal, and the change of length in ten millionths of the original length of the rod is plotted on the vertical, the elongations being plotted above, and contractions below, the zero axis. The line of bismuth, which metal was tested in fields varying from 500 to 840 units, almost coincides with the axis, and manganese steel was also found to be almost unaffected, the elongation in a field of 850 units being only about one-fifty millionth of the length. That the change of length in the other metals which are sensibly affected by magnetization cannot be due to the mechanical stress produced by magnetic attraction between the ends of the bar, is shown by the author in the case of iron where mechanical stress does not account for more than one-fifth part of the observed magnetic contraction. It should also be remembered that up to a magnetizing force of 280 units, iron elongates, and, therefore, the mechanical stress in iron opposes magnetic extension.

Primary Battery Lighting.

To the Editor of The Electrical World:

SIR: Can you tell me through your paper what kind of a battery it will take to run a 16 c. p. lamp of 70 volts?

C. A. S.

ANSWER.—Any good type of bichromate cell will answer your purpose. About forty large cells would be required, however.—EDS. E. W.

Instrument for Testing Telephone Transmitters and Induction Coils.

In making experiments upon the relative efficiency of various transmitters and the induction coils connected with them there has heretofore been employed the direct method of determining the current strengths by means of the electro-dynamometer. Experiments in this direction, it will be remembered, were made some time ago by Prof. Charles R. Cross. The strength of the currents generated for telephonic purposes, however, is so minute that the indications are very difficult to standardize in absolute units, and in order to avoid this, Mr. Hammond V. Hayes, of Cambridge, Mass., has designed an apparatus which, based upon the principle of the Hughes induction balance, affords a method of comparing the relative values of transmitters in terms of an arbitrary standard. The instrument which has

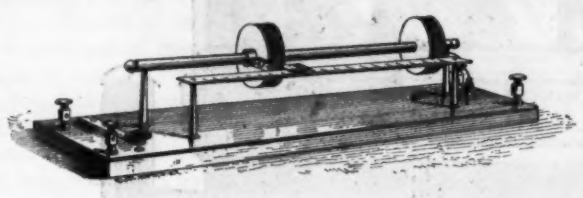
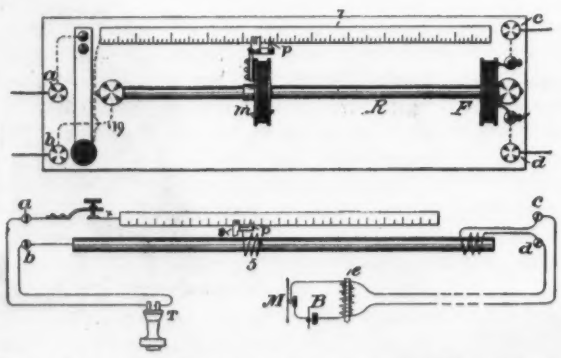


FIG. 1.—TESTING APPARATUS FOR TELEPHONE TRANSMITTERS AND INDUCTION COILS.

been designed for this purpose is shown in perspective in the engraving, Fig 1, and Fig. 2 shows the same in plan; Fig. 3 shows the electrical connections employed. As will be seen, a fixed coil *F* is mounted at one end of a brass rod the terminals of which are connected to the binding posts *c d*. Upon the same rod *R* is mounted a sliding coil *m*, one terminal of which is connected to an insulated pointer *p*, which passes over a scale, and the other terminal is connected to the brass bobbin upon which the spool is wound, and which is thus in electrical connection with the rod upon which it slides. The pointer *p* also makes electrical contact with the scale, which is of brass, and the latter is connected with the terminal *a*, with a key in the circuit. The brass rod *R* is also connected with the terminal *b* as shown. To the terminals *c d* is connected the secondary of the induction coil *e*, the primary of which is in circuit with the transmitter *M* and battery *B*; finally the terminals *a b* are connected to the telephone *T*.

In order to test the relative efficiencies of the induction coils and transmitters, the relative inductive actions between the two coils mounted on the rod are compared. Thus it will be evident that when the transmitter is operated the currents in the coil *F* will induce currents in the coil *m*, which will be made evident in the telephone *T*. By sliding the coil *m* along the rod *R*, a point will be reached at which the inductive action between the two coils is so weak as to give no sound in the telephone. This silence of the telephone is used as a standard in comparing the different apparatus. Thus it will be evident that transmitters of different powers will be able to effect inductive action between the coils at various distances, and in this way their relative powers can be determined. The key is inserted in the circuit in order to facilitate the location of the silent point, as at that point the telephone is silent whether the key be depressed or not.

The relative efficiencies of the various apparatuses are in the ratio of the square of the distance between the two coils; and since the strength of the induced current is



FIGS. 2 AND 3.—TESTING APPARATUS FOR TELEPHONES AND INDUCTION COILS.

directly dependent upon the strength of the primary current a basis of comparison can be readily established.

If the efficiency of a number of transmitters is to be compared, it will, to obtain the most accurate results, be necessary in each measurement to use the same induction coil and a constant battery. On the other hand, if it be desired to test the respective merits of a series of induction coils, it is advisable to employ the same transmitter for all. In ascertaining the fall in current along a line, Mr. Hayes first determines the distance between the coils at which silence is obtained when the apparatus is connected in circuit but a few feet from the transmitter *M*, and then observes how much nearer together the coils have to be placed at successively increased distances from the transmitting end of the line. In this way it becomes easy to map out with great accuracy the conditions of a telephone line as well as the carrying power of a transmitter.

The National Electric Light Association.

A meeting of the Executive Committee of the National Electric Light Association was held in this city on May 3. There were present Mr. S. A. Duncan, the president; Dr. O. A. Moses, chairman of the executive committee, and Messrs. Morrison, Ridlon, De Camp and Peck. Mr. Harding, the secretary, was in attendance. It was decided to hold the next convention in this city on Aug. 29, 30 and 31, at the Hotel Brunswick, on Madison Square. It will thus immediately precede the meeting of the National Telephone Exchange Association, which meets in this city also, the week after. Mr. Harding reports the association to be in excellent shape, with a membership of 181 companies, etc. The reports of the Detroit, Philadelphia and Roston meetings will be ready in about a month. A committee was appointed, with Dr. Moses as chairman, to look into the matter of insurance regulations, wiring licenses, etc., to report at the convention. The indications are that the August meeting will be one of the largest the association has had. The Telephone Convention comes the week after, also in this city.

Built-Up Dynamo Plants.

To the Editor of The Electrical World:

SIR: My suggestion in THE ELECTRICAL WORLD of March 31, in regard to built-up dynamo plants, seems to have been misunderstood in one important part. Mr. Ewing McLean, under date of April 21, proposes to build up a plant with six or more armatures in one continuous magnetic circuit. In my plan, I intended there should be at least *one* complete magnetic circuit for each armature, the same as in a single machine as now built. This, in my opinion, is quite different. S. P. VAN-NORT.

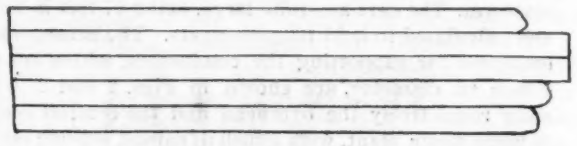
ST. LOUIS, MO.

Preserving Dynamo Brushes.

To the Editor of the Electrical World:

SIR: The accompanying sketch illustrates one of the "secondary" brushes I have had in use on a Thomson-Houston 45-light machine for two weeks without being clipped. The lights burn as well as they would with the brush in good condition, and the commutator does not wear half as fast as when I cut the brushes too often.

When the "forward" brushes get half worn through at



PRESERVING DYNAMO BRUSHES.

the ends I use them as "secondaries" and put the "secondaries" in good condition to use for "forward" brushes. W. B. H.

SAN LUIS OBISPO, Cal.

Carbon as a Positive Battery Element.

To the Editor of The Electrical World:

SIR: Will you please inform me through the columns of your valuable paper how to make a positive element to a dry battery out of manganese and carbon?

READING, PA. FRANK H. H.

ANSWER.—The use of carbon as a positive element in the voltaic battery is as yet in its infancy, such a cell having been recently described by Mr. W. E. Case. We have not heard of manganese being used in connection with it.—EDS. E. W.

Magnets with Consequent Poles.

To the Editor of The Electrical World:

SIR: I have a steel file that was magnetized on an electroplating dynamo, and by bringing a galvanometer near it it shows both ends to be north and the middle south. I have also another that is just the reverse of this. Can you inform me through your valuable journal the reason for this? A. B. C.

BATTLE CREEK, Mich.

ANSWER.—This is quite a common occurrence in permanent magnets, and the same are then said to exhibit consequent poles. Steel magnets can be magnetized with a number of such consequent poles at various points along their length.—EDS. E. W.

Wiring Houses for Different Systems.

To the Editor of The Electrical World:

SIR: Will you please answer through the columns of THE ELECTRICAL WORLD whether it is considered practical to wire new houses for incandescent lights, much the same as gas pipes are put in, so as to be ready to connect to any system that may be convenient? F. E. W.

TONAWANDA, N. Y.

ANSWER.—House wiring is usually based on such a small percentage of loss of pressure that, generally speaking, a house wired for one "system" of incandescent lighting might, without danger, have another "system" of the same kind substituted, and this sometimes happens. This only refers, however, to safety from overheating. But the percentage of loss calculated for one kind of lamps would be changed if lamps of different potential or resistance were substituted for those originally intended to be used.—EDS. E. W.

Co-Operation Among Telegraphers.

BY T. C. MARTIN.

The brilliant success achieved in various scientific, industrial and commercial fields by those who were once telegraph operators is well known. Some of the most distinguished men in this country began life at the key, and among those who now govern States, direct great enterprises and produce striking inventions are not a few who take pride in the fact that it was the telegraph office in which their first lessons in fortitude, perseverance and mastery of difficulties were learned. These instances of individual achievement are so numerous that in themselves they would constitute no mean portion of our national history during the past fifty years, while not a single record of electrical development in any line whatsoever can be made in which they do not fill the brightest pages.

This is a familiar fact, but it is far from equally well-known that telegraphers here have also been first and foremost in promoting a great movement of our times, which is as profoundly democratic as the ideas and principles that give to personal ability the opportunity of assertion. The sentiment that demands for every man fair play in life, the chance of development, and the liberty to rise to higher things, finds expression for itself also in the various practices of co-operation, and the telegrapher has been as keenly alive to the meaning of "mutual help" as he has to that of "self help." A brief statement of what has been done by operators as co-operators will be found at once interesting and significant.

The oldest institution calling for notice is the Telegraphers' Mutual Benefit Association, a body which is, to-day, the oldest assessment insurance association in the United States. It was established in 1867,

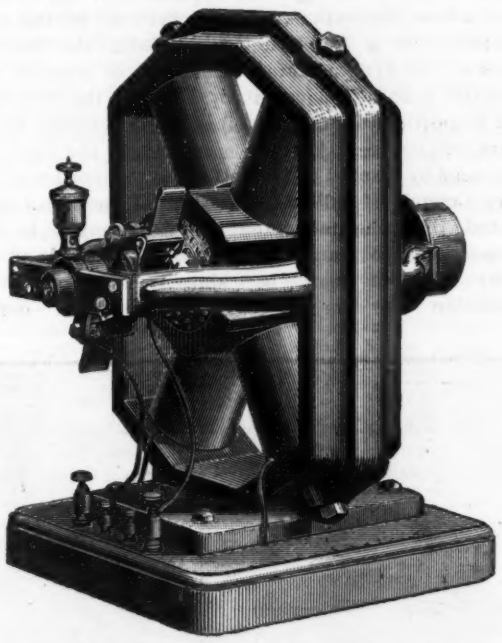


FIG. 1.—THE HILL DYNAMO.

with very humble beginnings. To-day it has a membership not far short of 3,500, and a reserve fund of not less than $65,000. It takes in all eligible persons in the telegraph or telephone service throughout the United States between the ages of 18 and 45, and its officers have at all times been picked wisely and carefully from the active list of prominent men. During its existence it has paid out to the widows and families of deceased members the sum of $350,000, and it has recently taken steps, by providing for a reserve fund of not less than 3 per cent. of the amount of insurance, to secure amply policies falling due hereafter. The assessments average from $10 to $12 per annum. The rate of growth of the association was never higher than it is to-day.

A body of like character with the above is the Gold and Stock Life Insurance Association now in its tenth year. This is open to all between 18 and 45 years of age engaged in electrical service, though its membership has hitherto been within the specific limitations of its title, and chiefly in New York and vicinity. It had last January 418 members, and had then paid out since 1879 the sum of $8,600 on death claims. It had at the end of the March quarter, 1888, a balance of $1,200. Its dues are 50 cents per month, and the death payments are due at the rate of $50 per month for one year, making a total benefit of $600. This feature is said to work extremely well. Under the present management, the association is growing rapidly.

Next in order comes the New York Telegraphers' Aid Society, which was organized in March, 1880, and is intended to render assistance to its members in sickness and in meeting burial expenses. Its "flat" dues are 50 cents per month, with an initiation fee of $1. There are no assessments. In case of disability, $8 per week is paid, but no member can receive more than $100 in benefits during any consecutive 24 months. In case of death, $100 is paid for burial expenses. During its career the society has paid out over $6,000 in reliefs, and its last balance sheet showed a bank credit of nearly $2,000. So notable has been its success that kindred societies have been organized in Boston, Philadelphia, Buffalo, Pittsburgh and San Francisco with the same good results, and others are now forming in St. Louis, Indianapolis and elsewhere.

The latest co-operative movement to assume importance is that known as the Serial Building, Loan and Savings Institution, which was incorporated under the laws of this State in 1885. There is at present a marked activity in this field, but the telegraphers may again fitly claim to have been foremost here in recognizing the great merits of the plan which enables the wage-earner to pay rent to himself and thus in time to own his home. The association is already in excellent shape and doing a work of the most praiseworthy character. At the close of 1887 it had

FIG. 3.

no fewer than 379 members, who held 2,463 shares, and of whom 77 were borrowers. To become a member, it is necessary to subscribe for at least one share of the stock issued in new series every January and July. An entrance fee of 25 cents per share is charged, and $1 per share is collectable every month. When the sum paid in on each share reaches, with the earnings, the sum of $200, par value, the account is closed, and the amount is either repaid to the members or is used to liquidate their indebtedness to the institution. Any member can borrow an amount equal to the $200 par value of each of his shares, giving as security real estate first mortgages that are critically appraised to be worth 25 per cent. more than the amount of the advance; or he can offer capital stock of the association of a paid up value equal to the loan, or he can make both tenders together. At every monthly meeting sums of money are put up to be loaned to any member in amounts that must not exceed $4,000, nor be less than $50, and the loan goes to the member offering the highest premium, which in no case is less than 15 cents per $200, and payable monthly, in addition to installments of interest,

FIG. 4.

at the fixed rate of 6 per cent. per annum. On this basis it can be seen, with the aid of a little figuring, that a home of moderate value, say from $2,000 to $5,000, can be bought within a period of ten years by a member for about the same money that he would have paid in rent, and for which, as a tenant, he would otherwise be

FIG. 5.

FIG. 6.

unable at the end of the ten years to show any equivalent. Of course, if the member does not desire to buy or build a house, the institution serves him as a savings bank, and, looked at from any standpoint, it is seen to be a powerful influence in making good citizens, in giving stability to society and in creating happy and prosperous communities. The association has already in its three years of existence loaned $100,000, and a large number of its members have acquired homes.

When it is remembered that the average salary of the telegraph official or operator is never very high, it will be admitted that the total sum of half a million dollars thus passed from hand to hand within the fraternity represents much exercise of courage, frugality and self-denial. The fact that it has been set aside out of small incomes and that each of the organizations is to-day vigorous, prosperous and well-manned, is so full of promise that we may well believe in the success of other departures yet to be made along the same lines. The principle that has thus been so admirably utilized in life insurance, sick relief, and the purchase of homes is as fertile of new applications as electricity itself.

A Novel Dynamo and Accessories.

Among the recent novel designs in dynamos is that brought out by Mr. W. S. Hill, of Boston, and shown in the accompanying engraving, Fig. 1. In this machine the supporting magnet frame is made of cast-iron, but the cores of the magnet coils are of soft wrought iron. The machine is shunt wound for incandescent lighting, and is said to give very good regulation. It has as yet been built only in small sizes, having a capacity of from ten to one hundred lights. An incandescent machine, weighing 280 pounds, maintains fifty 70 volt 16 c. p. lamps, running at 2,000 revolutions. A 10-light machine weighs 125 pounds.

A large machine for arc lighting is in process of con-

FIG. 2.—THE HILL ARC LAMP.

struction, and will be fitted with a new automatic current regulator recently patented by Mr. Hill. The arc lamp used in connection with the machine is shown in Fig. 2.

In a new cut-out switch designed by Mr. Hill and shown in Fig. 3, the contact terminals are mounted at either end of a base-board, and between them is placed a stand carrying two spring levers with insulated connectors of thin sheet copper. A cam lever operates to depress and close either circuit before the other can be broken; thus, if a loop or circuit of lamps in a building is to be cut into a main circuit, as the cam lever is turned the copper brush connectors will be pressed down between the inclined surfaces of the double-pole terminals of the new circuit, before the connection with the main can be broken. A stout spring that surrounds the axis of the spring levers is arranged to raise and open the circuit of both sets of connectors in common, as the handle is turned in either direction. The switch is covered with a box having a glass cover, through which the words "on" and "off" can be seen on the handle of the cam lever.

The illustration, Fig. 4, shows a double pole switch in which the same style of contact connectors are used as in the cut-out switch. Two pairs of contact terminals are placed in line on the case board, as shown, the inner sides of which are beveled so that when the wedge-shaped contact brushes are pressed down between them, a perfect electrical connection is obtained. The connecting brushes are secured to and insulated from the pivoted lever; as the handle is pressed down a projecting arm bears upon a cam surface on the lever and presses the connecting brushes between the inclined sides of the terminals and thus closes the circuit. When the handle is raised, bringing the projecting arm off the cam surface, a spring pressure raises the lever and makes a quick break at both poles simultaneously.

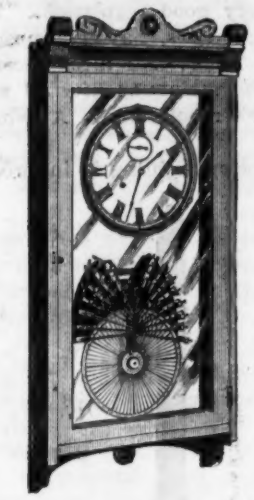
The contact surfaces are made especially large to carry heavy currents.

Figs. 5 and 6 show a key socket and lamp designed by Mr. Hill, the new feature of which is the manner of at-

taching the lamp to the socket. The lamp terminals are of stout wire, and are bent at right angles so as to form arms as shown in Fig. 5. As the lamp is inserted into the socket and turned partially round, these arms pass under wire springs that hold the lamp securely in place, and also put it into electrical connection with the circuit. A pin in the brass cap of the lamp and a groove in the socket insure the lamp entering in the right place, and limit the turning motion so that no injury can be done either to the arms or springs.

An Improved Watchman's Time Detector.

Our illustration represents the improved watchman's time detector made by the Redding Electrical Company, of Boston. The register is placed in the office and connected by wires to key stations, located at every point which it is desired to have the watchman visit, and into which he inserts his key (which fits all stations alike), gives it one full turn, after which the station automatically prints its number on the paper dial in the register. The stations are all independent of each other and may be visited in any order and any number of times; the record of any number of watchmen can be made on the same dial, and each watchman will be obliged to operate his respective beat at the same time the others are operating, therefore rendering it impossible for one watchman to relieve the other. The record can only be made by operating the station, and if attempt be made to open the door of the register it is recorded on the dial.



WATCHMAN'S CLOCK.

A Small Self-Regulating Dynamo.

Our illustration represents the improved self-regulating dynamo of small size built by the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. It will be remembered that the regulation of these machines is effected without shifting the brushes. It will be noticed that there are three brushes on the commutator—the two main brushes and an auxiliary brush. The current from the auxiliary brush passes to the lamp line outside of the field magnets, and the current from the upper main brush passes around the field magnets and then joins the current from the auxiliary brush, and the sum of the two is the current passing to the lamps. At the instant of cutting out lights the current from the main brush decreases while the current passing from the armature by way of the auxiliary brush increases; but this increase is in like proportion to the decrease of the main current, and the current on the lamp line, which is the sum of the two currents, remains normal. This balance which, it is true, seems difficult to conceive in practice, is yet vouched for to take place in the machine, so that its operation is perfectly automatic.

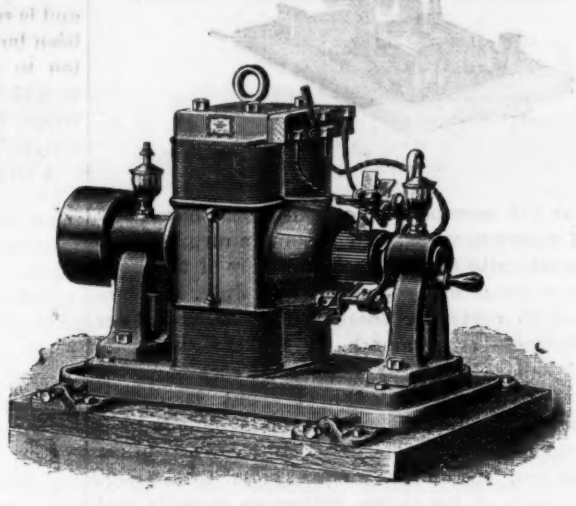
The new machine has been further improved by the addition of a new brush-holder, and the commutator is composed of drop-forged copper segments. The groove near the rim of the pan prevents any oil from saturating the floor, and the slides, with adjustable bolts, insure a tight belt. The dynamo illustrated is furnished with plants of 3, 5, 10 and 12 arc lights, and for incandescent plants of 30, 50 and 100 16-c. p. lights.

An Iron Concentrator.—The Conkling iron ore concentrator is running experimentally at Glens Falls, N. Y. It is a magnetic machine.

The Hopkins Telegraph Bill.—At Washington, on May 2, Dr. Norvin Green appeared before the House Committee on Post-Offices and Post Roads, to present some facts upon the subject of the telegraphic system of the country. He first addressed himself to the Hopkins bill to establish a postal telegraph. Such an enactment would be, he said, a monstrous wrong. The rights of property were entirely ignored. The average monthly salary of operators—male and female—in England was $26, as against $61.45 in New York. The 615 operators in the New York offices did about 15 per cent. less work than the 1,943 English operators. This was not because the English operators were not able to do as much work as the Americans, but solely because of the general loose methods of government employés.

The American Institute of Electrical Engineers.

The annual meeting of the Institute will be held, as required by the rules, on Tuesday, May 15, for the election of officers and the transaction of business. This meeting will be followed by a session on the 16th, when various interesting papers will be read and discussed. Among those now on the programme are: "Some Old and New Applications of Alternating Currents," by Lieut. F. Jarvis Patten, U. S. A.; "On Compensated Resistance Standards" and "On Professor Moler's 'Swinging Arm' Galvanometer," by Professor Edward L. Nichols, of Cornell University; "Subterranean Electrical Systems," by Professor George W. Plympton, chairman of the Brooklyn Subway Board; and on "The Possibilities and Limitations of Chemical Generators of Electricity," by Francis B. Crocker. The meeting will be held at the House of the American Society of Civil Engineers, 127 East Twenty-third street.



NEW WATERHOUSE DYNAMO.

The Carbondale, Pa., Electric Road.

We present herewith an excellent view of a car on the track of the Carbondale & Jermyn Electric Street Railway Company, which went into operation recently, using the Sprague system. The road is five miles long, and is built with 25-pound T rails and 57-pound flat rails. The overhead wire is used, and the illustration shows Mr. Sprague's method of making contact from the under side of the wire. The president of the road is Mr. J. W. Aitken, who is operating it from the Westinghouse electric light station.

CAR ON SPRAGUE ELECTRIC RAILWAY AT CARBONDALE, PA.

The Teleseme Company.—The Herzog Teleseme Company, whose electric signal service has been adopted by the Police Department, at a meeting of the stockholders held last week increased its capital stock from $250,000 to $500,000.

Narragansett Pier, R. I.—The Jarvis Engineering Company having been awarded the contract for the steam plant for the Narragansett Pier Electric Light Company's station, have started the work there and the station will be in readiness for lighting by the early part of June. The work of construction and inside wiring is also being pushed as rapidly as possible.

A New Electric Motor for Tramcars.

The fact that it requires much greater effort to start a tramcar than to keep it in motion afterwards, has led to the invention of many different devices in electrically-propelled cars, the most common of which is some method of increasing temporarily the strength of the magnetic field of the motor. The "Helios" Electrical Company, of Ehrenfeld and Cologne, however, assert that they have overcome this difficulty, using a motor, which in external appearance resembles that of Ayrton and Perry, the field magnets of which are keyed on to the axle of one pair of wheels of the car. The armature rides loose on the same shaft, but its rotation can be checked by a brake, in which case the field magnets will revolve, driving the car. One of the driving wheels is also fitted with a brake, which is connected with the one previously mentioned in such a way that by taking the brake off the armature that on the driving wheel is put on, and *vice versa*. To start the car when stopped, the current is turned on to the motor, which causes the armature to revolve; the brake handle is then shifted, releasing the brake on the car wheel, putting on that in the armature, the rotation of which is then transferred to the field magnets, and the car is driven in one way or the other, according to the direction of the current. It will be seen that this arrangement necessitates the use of a slowly rotating motor, as the wheels are driven directly, but the manufacturers assert that these can be made as efficient as fast running ones, which is no doubt true enough, if the item of weight, usually considered a very important one in self-propelling tramcars, is neglected.

A New Current Meter.

Prof. R. Boernstein, of Berlin, has devised a current meter of novel construction. It consists (1) of a dynamometer, whose indications are proportional to the current intensity; (2) a planimeter which integrates the deflections of the dynamometer. The axis of rotation of the movable bobbin is placed at an angle to the vertical, and the proportionality of the deflection is obtained by a very ingenious device. A sector is affixed to the axis, and is balanced by a small weight attached to a cord which runs over a couple of pulleys. The form of the sector is so adjusted that the movement of the weight is always proportional to $\sin \alpha \tan \alpha$, α being the angle of deflection; and it can be shown that under this condition the tangent of the angle of deflection will be directly proportional to the current. The rotation of the axis of the coil displaces a disc over which a wheel moves in such a manner that its velocity is proportional to the angular displacement of the disc. The number of turns made by the wheel is registered by a train of clockwork. The apparatus is available either for continuous or for alternating currents.

Telephone Legislation.—The Ainsworth bills in the New York State Assembly, fixing telephone rates, and limiting the issue of telephone stock, have been ordered to a third reading.

Busy Days.—The day the emperor died there were sent off from the Berlin telegraph office 29,878 messages, aggregating 799,926 words. On the following day this record was beaten with 36,615 messages, aggregating 1,115,551 words.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, May 7, 1888.

United States Plants.

It will be of interest to many of your readers to know that the Alleghany County Court House, Pittsburgh, Pa., is being rapidly fitted up with a United States plant, of 3,000 lights of 16 c. p., carried by 4 dynamos of 800 lights and one of 400 lights, driven by three 135 h. p. Armington & Sims engines, one of which, however serves as a reserve. Two large motors of the United States make will be used for ventilating purposes. I understand that the company received the award, although its figures were very much higher than those of any other bidders. The plant will comprise several new and improved features. Yankton, Dak., will have a plant of 500 incandescents and 20 arcs of 2,200 c. p. of the United States system, and the plant will be driven by spouting artesian wells. The plant is now being installed. The Pennsylvania Railroad Company are installing a plant in their depot of four 400-light incandescent machines, being an increase on the old plant. A big Corliss will be put in in place of the present engines by the Watts, Campbell Company. The United States Company will also put in another of its marine plants on board the new and elegant sound steamer "Connecticut." There will be two 400-light dynamos coupled direct to two Brotherhood engines. A special feature of the plant will be the use of two sets of indicating instruments, one in the dynamo room and the other in the engine room, acting as a check upon each other. The chief engineer will have a potential indicator in his private room, so that he can see the conditions of the circuit at a glance. Habirshaw insulated wire will be used throughout. The decoration work on board the steamer is to be done by the well-known firm of Herter Brothers, and the lamp fixtures are to correspond with the other ornamentation in richness and beauty.

A Fire-Proof Engine.

Mr. Gardiner C. Sims, the well-known general manager of the Armington & Sims Engine Company, writing to a friend in this city, says: "I have just returned from Fall River, where, after examination, I think that the electrical part had nothing to do with the origin of the fire in the Edison station. Our engines are in splendid condition, and I did not know before that our company built a fire-proof engine. Only one new pulley and a few new oil cups will be required. The steam plant comprised two engines of 125 h. p. each, and one of 50 h. p., and I think $150 will completely cover the loss on them. The boilers are not injured, and one of them now has steam on. The chief damage is that connected with the dynamos and the electrical part. The company have borrowed 4 dynamos from mills here, and two will be sent on at once from New York." I hear, by the way, that as indicated, the station went into operation again almost immediately, and is now carrying its full load.

Removals.

The Union Indurated Fibre Company continues to experience a very active demand for its now well-known specialty, and in order to secure better accommodations is removing to 37 Barclay street.

The Metropolitan Electric Service Company, who control the Johnson heat regulating apparatus, have removed their general offices and storerooms to 35 East Fifty-eighth street, New York.

The Electric Construction and Supply Company,

of 87 Liberty street, now have a large number of their Simplex arc lamps running on incandescent circuits, both direct and alternating systems, all over the country, and have now come to see the necessity of duplexing the lamps. They are prepared to receive orders for double carbon lamps for all-night use. They report business active in the construction line. The company are the sole agents for Mr. C. P. Reilly's protector for electric lamp sockets. It forms an air-tight cover for the socket, being a security against dampness of all exposed parts, also acid fumes, changing influences of the weather on lamps in outdoor use, as for street lighting, steamers, ferry-boats, chemical works, cellars, ice-rooms, etc.

T. F. Hunter & Co.

The above new firm, of 37 Church street, are just at present putting in a plant on the Loomis incandescent system for Henry Wanklin, of Philadelphia.

The Teleseme Controversy.

Mayor Hewitt has received a copy of a letter addressed by Police Commissioner Fitz John Porter in defense of the latter's favorable position toward the Herzog Teleseme Company's system of police signal boxes, against the adoption of which Police Commissioner John R. Voorhis has so vehemently protested The Mayor ordered the letter to be printed in the *City Record*, together with the minutes of the meeting of the Police Board held on May 1, at which the letter was first read. Gen. Porter defends the system which the Herzog Company owns, and denies that there is any jobbery in the attempt to have the city adopt it. With reference to Commissioner Voorhis' position in the matter Gen. Porter is rather severe. It is intimated that Mr. Voorhis has done several things which he should not have done. Attention, it was said last week, is called to the fact that reports and other papers favorable to the system so bitterly opposed are missing from the records of the Police Department. Gen. Porter resents in the most positive manner the imputation that any undue influence was used or intended to be used to further the interests of the Herzog system with the Board of Police.

The Sprague Company.

The Sprague Electric Railway Company has been so busy the last week or two that it has not yet found time to move into its new offices in the same building. The orders that are coming in on the company from all quarters are larger than ever, new contracts and new customers being found often where least expected Mr. Harding tells me that the reports from the West are all of the most encouraging character. Large numbers of Sprague motors are now running in St. Paul. The number at Des Moines, Iowa, is on the increase. Grand Rapids, Michigan, sent in its orders for a large number, and at Sault Ste. Marie, the installation of motors is quite active.

At Chicago, where a great many of the motors are now in use, two of 10 h. p. and one of 5 have just been put in the Phoenix Insurance building, to drive the ventilating machinery, and the installation is said to be of a very creditable nature. I may add that Mr. David Barclay, who is a brother of Messrs. C. M. and J. L. Barclay, of Chicago, has just arrived from Scotland, and will make his home in Chicago also. He is a railroad man, and may be counted upon to make a good record in that line of work. I am not informed whether there are any more Barclays coming, but if there are they will be cordially welcomed, as there is plenty of room for good pushing men with the right stuff in them.

Hill Clutch Works.

Mr. Wonham, the New York manager for these works, informs me that they have recently equipped the United States Electric Lighting Company's plant in Philadelphia complete with the Hill clutch pulleys and cut-off couplings. The plant is now a model one, and those who are interested in clutches as applied to dynamo work and cutting off heavy lines of shafting, would find it greatly to their advantage to visit and inspect the plant.

Cotton Leather Belting.

Mr. A. B. Laurence has experienced a good demand for the Underwood cotton leather belting, which he represents, and among recent electric light orders are four belts for the cruiser "Chicago," one for the American Tract Society, one for the Broadway car stables, two for the Broadway Theatre, one for the "Mary Powell," and others for the "Saratoga" and "City of Troy," the Morristown, N. J., Electric Light Company and the United States Express stables at Jersey City.

The Daft Electric Light Company.

The business of the Daft Electric Light Company, in the field of locomotive and stationary dynamo-electric power machines, has arrived at such proportions that its present establishment at Greenville, N. J., is totally inadequate to deal with it, and a change of base has for some time been felt to be imperative. The remoteness of the present works from railway or water communication made any extension of them unadvisable, and the company has purchased a large building at Marion, N. J., which is a familiar sight to travelers on the Pennsylvania Railway. It stands on the south side of, and near to, the track, about six minutes from the Jersey City station, in an enclosure of nearly two and a half acres, showing a frontage of 256 feet, three stories high, in iron and glass, and is supplemented by a brick wing in the rear, also of three stories, 142 by 80 feet in length and breadth. The available floor space in the building is about 85,000 square feet, and the yard room is somewhat over two acres. The building is already provided with steam power to the amount of 120 horse, which will be further increased in its re-equipment. It is also provided with elevators. The transference of the machine tools, *matériel*, etc., from Greenville is already in process, but will be conducted deliberately and with a view to delaying as little as possible the current work, which has accumulated to the degree of making this removal an indispensable necessity. The Daft Company have the intention of making this new establishment one of the largest and most comprehensive electrical manufactories in this country, if not in the world. Its technical and financial ability to do this is fully assured, and the realization of its purpose is well within the limits, not only of possibility but probability.

The Hussey Battery.

A new primary battery, open or closed circuit, has been brought out by Mr. Hussey. It is of the porous cup style, using plain water, which avoids the bother of placing salts in the jar; and there is said to be absolutely no local action. Mr. W. A. Vail, the well-known telephone exchange superintendent, spoke to me last week in the highest terms about this battery; he has one of them in use in his office on his private telephone. He placed it on closed circuit for 158 hours. At the beginning of the run it showed 2⅛ ampères, and at the end it actually tested at 3 ampères. It never polarizes, but uses up all the elements without waste. The battery just mentioned after its "break the record" performance of 158 hours is still healthy and in matter-of-fact ordinary use on the same telephone. It will maintain over one volt E. M. F. during open or closed circuit action. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
48 Congress Street, Boston, May 7, 1888.

Personals.

Mr. F. E. Newbery, of England, a thoroughly well trained young electrician with first class credentials, has now become connected with the Malden, Mass., Electric Light Company. He will be found a good man for any position of responsibility.

Mr. Henry B. Cram, treasurer of the Bernstein Electric Light Manufacturing Company, was elected chairman of the House and Entertainment Committee of the Boston Electric Club at a special meeting of the Executive Committee of the club on Monday evening, April 30, *vice* Mr. Arthur H. Chapman, who resigned owing to sickness in his family.

Mr. Arthur G. McClure, with the New England branch office of the Sawyer-Man Electric Company, was united in the bonds of matrimony to Miss Hattie Hill at Melrose, Mass., on Monday evening, April 30. Immediately after the marriage ceremony the young couple departed on an extensive tour through the Southern States.

Messrs. Eugene Phillips and W. H. Sawyer, of the American Electrical Works, of Providence, R. I., were on a business visit to Boston last week. The former without his moustache, lost on an election bet, passes very well as Mr. Young, of Nebraska.

Mr. A. F. Upton, of the Jarvis Engineering Company, returned home on May 2 after several weeks' absence in the South. Mr. Upton now contemplates a trip across the ocean, and probably will spend the Summer abroad.

Refurnished Offices of the Providence Long Distance Company.

The Long Distance Telephone Company's offices, at Providence, R. I., have undergone a complete refitting and refurnishing. The various departments for local and long-distance telephone circuits—telegraph and messenger business—are systematically divided off, neatly furnished, and respectively equipped with the latest improved instruments and apparatus. The district messenger service, which forms an important adjunct to the telegraph department, has in its employ 25 intelligent and neatly uniformed boys. To the manager, Mr. C. G. A. Peterson, is due all the praise for the creditable manner in which the changes above referred to were made; and it is to that gentleman's discipline and vigilance that the various departments are so satisfactory to the parent company.

The Glass-Workers' Strike Ended.

A dispatch from Sandwich, Mass., dated April 30, states: "The workmen employed in the Boston and Sandwich Glass Works received official notice yesterday that the strike or lockout which has been going on in all the factories in the United States since Jan. 2 was declared off."

Boston Electric Club.

The regular monthly meeting of the club will be held this (May 7) evening at its rooms. A large attendance of the members is expected, as business of importance will be acted upon and the celebration of the first anniversary of the club—which will occur on June 21—will be discussed at this meeting.

A New Electric Light Station.

At a recently held meeting of the Cambridge, Mass., Board of Aldermen, the Cambridge Electric Light Company was granted permission to set up and maintain eight steam engines and boilers in a building to be erected on Albro street. Permission was also granted the company to erect 23 poles on River street and 19 on Western avenue.

Another Electric Light and Power Company.

"On April 17," writes a correspondent, "the Bridgewater, (Mass.) Electric Light and Power Company was organized. The following named gentlemen were elected directors: R. C. Breck, E. C. Linfield, John Post, Jr., S. P. Gates, A. I. Simmons, B. W. Harris, F. C. Nutter and W. A. Stiles. The two gentlemen named first were elected treasurer and clerk respectively." It is said that the station and its electric light and power equipment, together with all the poles and circuits, will be in position and the lights ready to start up by the second week in June.

The Eco-Magneto Watch Clock.

The Eco Magneto watch clock is being rapidly introduced, and attracts a great deal of attention on account of the novelties of its construction and arrangement. It is a watchman's electrical clock, registering at the various stations the visits of the watchman as he patrols his beat; yet this is done without the use of any batteries requiring in their care and management more or less electrical knowledge. The electricity proceeds from small magnetos at each station, and the act of turning the key a portion of a revolution by the watchman in the operation of "driving" revolves the armature of the magneto very rapidly, which in turn gives a vibratory motion to the armature of polarized magnets. Inside the case of the clock, attached to the armature of this magnet, is a short arm containing the pointer which perforates the paper dial which is carried around by the mechanism of the clock once in twenty-four hours. This dial is divided up in the usual way with radial lines corresponding to the divisions of time into hours and quarters, so that the record of the visits can be very easily estimated by a glance at the sheet, while concentric circles denote the position of the stations.

This apparatus is free from sophistication or fraud on the part of the watchman, in a peculiar manner, for there is no electricity in any part of the system, except at the instant of making the record, and only at that instant, when it is generated by the act of the watchman for that purpose. The record cannot be made in any other way, except from the several stations; and furthermore the apparatus cannot be made to register a false record by any method of crossing wires or other devices which have been employed by unfaithful watchmen in other forms of electric watch clocks. Such an apparatus, which is moderate in its first cost, durable and not requiring skill or expense for maintenance or repairs, supplies a field which, it is thought, is not fully covered either by the more expensive electric registering clocks on the one hand, or the portable mechanical ones on the other. The company, of which Mr. C. H. Thayer is president, Mr. C. A. White vice-president and manager, and Mr. I. B. Sayles treasurer, has its office at 105 Summer street, this city.

Removal.

The New England office of the Mather Electric Company, of Manchester, Conn., Messrs. Claflin & Kimball, agents, has been removed from 148 Federal street to No. 105 Summer street, Boston.

A New Series System.

Mr. H. H. Cutler, superintendent of the Newton, Mass., Electric Light and Power Company, has just completed the apparatus designed by him for a new system of high tension street lighting. This will be shipped to Australia at an early day for exhibition at the Melbourne Exposition. It is a multiple series system, and used without the aid of a transformer. It will be operated by Thomson-Houston alternating dynamos.

A Meritorious Oil-Cup.

Among the best sight feed lubricators now in extensive use in this and other countries is that manufactured by the Seibert Cylinder Oil-Cup Company, of Boston. The popularity of this cup is well attested by the fact that the company has just completed its ten thousandth lubricator, and the demand for them is steadily on the increase. The merits of this lubricator are too well known to require an explanation; yet it may be said that they are destined to become an essential feature of steam engines, combining as they do perfect lubricating qualities, with economy in the use of oil, and what is more important, a great saving in the wear of machinery by the absolute prevention of friction.

The company's patents have frequently been sustained by the United States courts, and several infringers have been enjoined from the manufacture and sale of sight-feed lubricators.

Erie Telephone Report.

The following item is clipped from the Boston *Herald* of May 8:

Erie telephone was steady at 32@32¼. A regular quarterly dividend of ¾ per cent. and an extra of ¾ per cent., making 1½ per cent., is declared, payable May 14 to stock of May 7. The

books will be closed from May 7 to June 13. The report for the first quarter of 1888 is a pleasing one, net earnings increasing a little more than the amount of the extra dividend, and there was a handsome surplus of more than ¼ per cent. after paying the dividend and construction charges. The increase of subscribers was a little less than for the 1887 quarter. The exhibit follows:

Quarter March 31.	1888.	1887.	Increase.
Earnings	$156,505	$138,823	$17,682
Expenses	97,119	92,209	4,910
Net	59,385	46,614	12,771
Dividend	36,000	24,000	12,000
Construction	8,483	10,090	*1,607
Surplus for quarter	14,901	12,523	2,378
Subscribers added	155	206	*51
Total subscribers	10,543	9,722	821

*Decrease. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., May 5, 1888.

Electric Railways.

At the last meeting of City Councils the committee on street railroads took up an ordinance providing for a practical test of the Rapid Transit Electric Railroad Company's motor. The bill provided that the consent of the Councils shall be given to the use of Twenty-ninth street so far north of Norris street as it may be opened, for the purpose of demonstrating to Councils the practicability of the operations of the electrical cars. Mr. Crawford Spear, on behalf of the company, made a brief statement of its intentions, and claimed that this electrical system would largely do away with the demand for elevated railroads. A clause was added requiring that security in the sum of $10,000 shall be given in order to bind the company to restore the street to its original condition should the road be abandoned. With these amendments it was agreed to report the bill favorably.

Ball Engines.

The reputation of the Ball automatic cut-off engine, made by the Ball Engine Company, of Erie, seems to be as well known abroad as it is at home. English capitalists are now negotiating with the parent company at Erie with a view of obtaining rights by which they may manufacture these engines in Australia.

A New Private Plant.

The new Thomson-Houston 50 arc-light plant in the store of I. H. Sultzbach, at Thirteenth and Green streets, was successfully started last Wednesday. A 60 h. p. Ball engine furnishes the power.

The Girard Insurance Building.

The Girard Life Insurance, Annuity & Trust Company have placed their order with the Harrison Safety Boiler Works, of Philadelphia, for two boilers, aggregating 216 h. p., together with one of their Cochrane patent feed water heaters and purifiers, for the new building now being erected at the corner of Broad and Chestnut streets, Philadelphia, which will be one of the most elegant office buildings in the city.

To Displace Arcs.

A special dispatch from Pittsburgh, of May 2, says: M. de Routhamsky, Secretary of the Russian Legislation, was in the city yesterday and spent several hours in consultation with George Westinghouse, Jr., and other members of the Allegheny County Electric Light Company. In explanation of his errand he said: "I came here on behalf of a fellow countryman, for whom I have just concluded an important contract with Mr. Westinghouse relating to incandescent electric lamps. My countryman has made a discovery which will probably have a greater influence on electric lighting than any of previous years. I am not at liberty to give the details of my transaction here to-day, but I will say this much: The discovery relates to a filament, to be used in incandescent lamps, that is capable of standing so high a temperature that from two to four times as much light can be secured from a given expenditure of power as has been claimed by the Westinghouse and Edison companies. The lamps which are supplied with those filaments will give more light for the horse-power than two arc lamps, and I think it is reasonable to look forward to the gradual displacement of the arc light. I think the effect on electric lighting will be very marked, as it will at once double the capacity of existing plants and will save 10 per cent. in fuel, which has all along been about one-third of the cost of operating."

Men-of-War Plants.

All of the new Government vessels now being built in this city will be provided with complete electric light plants, and electricity will be used in every possible way. Two of the new vessels, the "Yorktown" and "Vesuvius," the dynamite cruiser, were launched last Saturday, and work on the fittings and machinery will be commenced at once. E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, April 28, 1888.

Thomson-Houston Company.

The Thomson-Houston Company, among recent contracts, report the following: 75 arc lights for increasing the Fremont Electric Light Co.'s plant at Fremont, Ohio; 70 arc lights for increasing the Lawrence Gas, Coke and Coal Co.'s plant at Lawrence, Kansas; a 30 arc light plant at Mankato, Minn.; also a 30 arc light plant at Madison, Wis.

Mather Electric Company.

The Western branch of the Mather Electric Company, J. H. Reid, Manager, has just moved from its office at 38 La Salle street into No. 11 Metropolitan Block.

Nebraska to Have More Light.

A correspondent writes me from Craig, Neb., that Norfolk, Neb., has subscribed $5,000 for electric lights; also that Tecumseh, Neb., has incorporated an electric light company and $8,000 has been voted towards electric light.

Electrical Protective Supply Company.

Mr. H. G. Smiley, formerly secretary and general manager of the Electrical Protective Supply Company, has resigned his position with that company. The officers of the company are now George E. Marshall, president; J. M. Lyon, secretary, and F. S. Terry, well known to electrical people as manager of the Electrical Supply Company, treasurer. Mr. Fred. DeLand, who has been with the company temporarily, will resume his position as traveling salesman for the Electrical Supply Company.

Central Electric Company.

The Central Electric Company, McKinlock Brothers, moved this week into their new store at 42 La Salle street. Their office will be located on the ground floor, which will also contain a full exhibit of goods of all kinds, consisting of bells, annunciators, batteries, gas burners, etc. This floor will also contain their shipping facilities. The basement will be used for storing wire, etc., among which may be mentioned "for instance," the well-known "Candee" weatherproof, underwriters', and Okonite. The upper floors will be used for storage of all the various goods which they will carry in stock, and will consist of everything in the line of electric lighting, telephone and telegraph supplies. Their increased facilities will enable them to meet the demands of their rapidly growing trade.

The United States Electric Company

Have just moved into their new and elegant offices in the new Rookery Building, No. 146.

The Excelsior Company.

The Excelsior Company, F. W. Horne, Western Manager, has just been awarded the contract for lighting the new building of the Mercantile Library Association of St. Louis. This building, which must have cost nearly a $1,000,000, is said to be the finest ever put up in St. Louis. Contracts for engine, incandescent lights, etc., up to date have not been let.

The Post-Office Plant.

The P. O. electric light plant is running about 2,500 lights, both night and day. Mr. Cobb, the chief engineer, informs me that he has succeeded, within the past few months in bringing the high average breakage per day from 30 lamps down to $5\frac{35}{100}$ per day for April, for March $7\frac{6}{100}$, and February $7\frac{35}{100}$. It seems like a remarkable record and reflects great credit upon Mr. Cobb and his subordinates.

The Ide Engine.

I have the following from A. L. Ide & Son, of Springfield, Ill.: "The demand during the past six months for our 'Ide' and 'Ideal' automatic cut-off engines has been greater than ever before in our history, and much in excess of our capacity. We are now crowded with orders and working nights. We are now building an addition to our shops, which will be 50 feet by 180 feet, 20 feet ceilings, and equipped with traveling power crane and the most modern tools for our work. Recent shipments are Chicago & Northwestern Railway, for Clinton, Iowa, one 40 h. p. Ide engine, their Chicago depot one 60 h. p. Ide engine, and for Escanaba, Mich., one 60 h. p. Ideal engine, all for driving electric lights. Also Fond du Lac, Wis., Gas Company, one 80 h. p. Ideal; Hibbard, Spencer, Bartlett & Co., Chicago, one 60 h. p. Ide; Chicago City Railway Company, for Twentieth street station, one 60 h. p. Ideal; Consolidated Coal Company, of St. Louis, one 100 h. p. Ide engine. We are building one 60 h. p. Ide for Mr. McCormick, of Chicago; one 80 h. p. Ideal for Excelsior Electric Company, for Union Stock Yards; one 45 h. p. Ideal for Western Edison Electric Company, Denver; one 200 h. p. Ide for Union Cement and Lime Company, Louisville, Ky. Also building 100 h. p. Ide engines for the Chicago Auditorium Building, to be in operation in time for lighting the building for the Republican National Convention."

Doings in the City Council.

At a meeting of the City Council on Monday night, the Union Passenger Railway Company petitioned for permission to lay and operate a double track surface road, using either electric or horse power, past the County Hospital, the road to operate the line along Wood street, between Thirteen street and Carroll Avenue. The matter was referred to the committee of public service.

Removal of Telephone Wires.

Mayor Roche, on Monday last, requested Superintendent Phillips, of the Chicago Telephone Company, to furnish him a complete list of all telephone subscribers who desire to move May 1. The Council has refused to allow the telephone company to remove the wires for such subscribers, and the Mayor proposes to assume the responsibility of accommodating such persons himself. The city will itself remove the wires for the subscribers and charge the cost to the telephone company.

New Postal Telegraph Office.

The Postal Telegraph Company has moved into handsome quarters in the Phœnix Building, and now has one of the best offices in the West.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$160@	$165	Iowa Union	$26@	$27
Central Union	47@	48	Michigan	79@	80
Chicago	375@	400	Missouri and Kansas	70@	72
Colorado	19@	21	Rocky Mountain Bell	40@	45
Cumberland	65@	68	Wisconsin	108@	109
Great Southern	35@	40		E. L. P.	

COLUMBUS, Ohio.

The Fair Ground branch of the Consolidated Street Railway Company's line, which is operated on Short's series electrical system, is undergoing some extensive additions. The curve in the track is being enlarged to enable the speed to be maintained throughout the run, and the track is being leveled up after the winter settling. The engine-house has been torn down and will be replaced by one of sufficient size to hold the new engines, boilers and generators for the entire High street line in addition to those necessary for the Fair Ground branch. The new steam plant is expected here by the last of May, when the road will be put in operation. The engines and boilers are 125 horse-power each, and are being made by the Taylor Manufacturing Company, of Chambersburg, Pa. The engine-room is to be fitted up with the finest steam appliances, and all the labor-saving devices necessary to run the plant on an economical basis, and when completed will be one of the neatest generating systems in the country.

There is every prospect of the contract for the West Broad street line being signed soon, as they hope to have it fully completed before the Centennial opens. This line will be equipped with single track and turnouts, handsome new cars, a new road-bed and the graceful iron arch supports for the elevated conductors, such as are used on High street. This line will run at a higher rate of speed than the High street line, as at least half of it is beyond the city limits, where the speed can be increased. They intend to make the trip of four miles in fifteen minutes, including stops.

The Greenlawn branch will be refitted in the same manner as the main line, which will be a great accommodation to the public, as it is a torture now to make the trip on the street cars.

Manager George Cole, of the Western Union office, speaks highly of the Sprague motor, supplied with current from the Edison circuit. It replaces a noisy water motor in furnishing the compressed air for the message tube running from the receiving department to the operating room. One has but to visit Mr. Cole to see the best wired office in this part of the country.

The American District Telegraph Company, lately reorganized, and now in charge of Mr. J. D. Clarke, formerly Baltimore & Ohio superintendent at Chicago, is showing rapid improvement in its equipment and service.

The telephone company have been in their new quarters less than a year. The rooms are all on one floor, and all wires are brought in by cables, then enter over a window to the cross-connecting board, the lightning arrester being at the pole junction boxes. The main operating room is well lighted and contains eleven sections of the Western Electric multiple switch-board. When all connections are made it will hold 5,000 lines. In a room adjoining this is the double board, used for the toll lines. One of the neatest features of the office is the new cross-connecting board, which gives easy access at all times to the cross connections. It is a marvel of compactness and simplicity. I understand it was partly invented by a former employé by the name of Cook. Not the least attraction is the pleasure of meeting the efficient manager, Mr. Frank P. Ross.

Mr. E. McMillan, manager of the Columbus Gas-Lighting and Coke Company, well known by all gas managers, reports that his company have had ordered for some time and will shortly have in operation two Westinghouse alternating current dynamos, each of 1,300 lights capacity. These lights will be offered to the users of incandescent lamps at a less rate than they are now paying.

In addition to these Columbus notes it may not be without interest to refer to a request addressed by Prof. Benj. F. Thomas, Professor of Physics at the Ohio State University, which is located in this city, to the General Assembly for a special appropriation which was to be used to establish a department of electrical engineering at the University. The University is one of the most vigorous younger State institutions of the West, and its rapid growth within the last five years argues well for the future. There has been a growing demand for special instruction in electricity. Hence the request, the reasonableness of which ought to have struck any one only partly familiar with the rapid growth and development of the science and art of electricity. The Legislature, however, failed to make the appropriation asked for. The friends of the institution hope that next year will bring the necessary additions to the course of instruction.

The officers of the Columbus Edison Electric Light Company are: President, Charles H. Lindenberg; manager and electrician, William C. Turner; superintendent, M. Fisher. This company was organized May 14, 1887, with a capital stock of $200,000. Ground is owned by company, and is 187½ feet long by 62½ feet wide. The building is two stories in height, except boiler room. It is entirely new, finished throughout with Georgia pine, oiled and varnished. The managing offices have every convenience for demonstrating the different methods of lighting and showing motors, etc. The building cost $12,000. The station contains eight No. 20 dynamos, four Armington & Sims 150 h. p. engines, and four new Root 125 h. p. boilers. The station is very complete, having all the modern improved station apparatus, and runs the whole 24 hours. The underground system contains eight miles of mains and feeders, costing alone $50,000. The capacity is 8,000 16 c. p. of the new lamp. The lamps now connected number 5,500 16 c. p. The company have in use quite a number of 100 c. p. lamps, which are giving excellent satisfaction. There are some 200 customers, more than half on meter basis. Light is sold at the same rate as gas. There are now in operation 12 motors from ½ to 15 h. p., giving very good results. The company now light the Opera House and part of the State House. Owing to the great business ability of Mr. Turner, the business of the company is rapidly growing, more lights and motors being wired for each week.

The Columbus Electric Light and Power Company was incorporated Oct. 1, 1883, and started up on that date with two 25-light arc dynamos of the Thomson-Houston system, obtaining their power from the Columbus Machine Company. On Dec. 20, 1883, they started up in their present station with one engine and two 25-light dynamos, having in circuit 33 2,000 c. p. arc lamps. The company have running to-day seven engines and fourteen dynamos, with 325 commercial arcs and 150 street lamps in circuit; also 1,100 incandescent lamps in use, all of the Thomson-Houston system. The engines are made by New York Safety Steam Power Company. The company have orders now for street lighting which will increase the number of lamps so used to 300, making a total of 625 arc lamps, necessitating another increase in engines and dynamos, which have been ordered. A battery of new boilers has just been put in of 300 h. p., making a total boiler capacity of 800 h. p. Some 30 feet have just been added to the chimney. The company are now running quite a number of motors off the arc circuit. The motors used are the Brush, giving in all cases entire satisfaction. The new street circuits show up by reason of the material used and neat arrangement, all lamps being suspended over the street by mast arms. The great care taken by Mr. J. G. McGuill, manager, explains the excellence and success of the plant.

MENDOTA, Ill.

The Mendota Electric Light Company is operating a plant of 25 Thomson-Houston arcs and 200 Westinghouse direct-current incandescents. The lamps are all rented for commercial lighting, the incandescents being located within a radius of 600 feet from the station. The company has been doing business nearly four years and has paid satisfactory dividends from the start. It is incorporated under the laws of the State, with its capital stock of $12,000 in the hands of local capitalists, a large proportion of the stockholders being patrons of the company. The motive power

consists of an Ide high-speed engine, belted direct to the two dynamos, a Baragwanath heater, Blake duplex pump and tubular steel boiler, set with Jarvis furnace, all of which is contained within a fire-proof brick building located in the centre of the business portion of the city. The company contemplates an enlargement of its plant to double of its present capacity by the addition of about 500 incandescents, of some long-distance system, as soon as satisfactory arrangements can be made with the manufacturers of electrical machinery and supplies. The same remarks apply to the item of steam plant and motive power necessary for the enlargement. The increase of plant is prompted, as usual, by the prevailing desire for "more light," and has for its basis the popularity of the existing service. The executive officers are: D. Rude, president and treasurer; M. A. F. Haass, secretary; L. R. Curtiss, general manager.

LARAMIE, Wy. Ter.

The Laramie Electric, Gas-Light and Fuel Company was organized in 1886 by the present manager, R. M. Jones. It started in June of that year with 920 lamps of various candle-power. In June, 1887, it had 1,693 lamps, and at this time it has 4,000. The plant was all laid out on the plans of Mr. Jones, to whose efficient management the success of the company is largely due. It consists of a brick building 36 × 100, with 13½-foot ceiling. In the front are the office and motor and fixture rooms. Next come the engine and dynamo rooms, and at the rear are the boiler room and coal shed extension. The power plant consists of three steel tubular boilers from Brownell & Co., Dayton, O., 54 in. by 16 ft., Jarvis setting and Sheffield grate bars; an Ide steam pump, and a Hancock inspirator; steam drum and steam pipe covered with Shields & Brown's specialty; two Ide engines, high speed, 13½ × 18, 227 revolutions each, furnishing power to ten No. 16 Edison dynamos of 320 ampères each at 125 volts. The engines are right and left hand, each connected to one end of a 5 foot shaft divided into two sections, the engines being each connected also by rigid clutches to opposite ends of the two sections, and the sections being connected when desired by a rigid clutch also. There is in addition an Ide engine, 8 × 10, at 340 revolutions, furnishing power for an Edison municipal dynamo, type A, 16 ampères at 1,200 volts, and one designed and built by Mr. T. C. Beck, engineer of the works, 4 × 6, running a line shaft for driving a lathe, emery wheels, etc. There is a full assortment of ammeters, Howell pressure indicators, lightning arresters, etc., and an equipment for meter work, with a capacity of 200 meters. The electrical work was constructed by M. E. Bates, of the Edison Company, and consists of a system of wires on the three-wire plan, fed by eight sets of feeders and covering 110 blocks, each 350 feet long. The wires running north and south are in the alleys, and those at right angles are in the streets. In some places the wires extend 1¼ miles from the station. Originally there were 16 pressure equalizers to control the pressure of the system, but they have been replaced by a balancing construction of feeders designed by Mr. Jones and explained at the meeting of the Edison Association in Chicago last January. Lamps of 109 volts are used, and the E. M. F. at the station never exceeds 114⅓ volts. For the last nineteen months no interruption of the current at night has occurred. Current is now supplied day and night, and several motors are in use. The municipal system supplies 138 lamps of 20 c. p. for street lighting and has a capacity of 250. The company have an exclusive franchise for ten years, and have declared dividends every six months since starting on a capital stock of $75,000 fully paid up. In addition to the officers already named are M. N. Grant, president; J. H. Symons, vice-president; J. W. Donnellan, treasurer, and B. L. Smith assistant Secretary.

MINNEAPOLIS, Minn.

The Minneapolis Brush Company are using petroleum under their boilers with very great success. Besides being cheaper than coal, it does away with about half of the help formerly employed.

The Minneapolis Electrical Club, organized during the past winter, already has a goodly number of members, who are constantly being added to. For the present they have their semi-monthly meetings at the Permanent Exhibit, in the Boston block, where lectures are given by prominent men, and papers are read and discussed. Their display of instruments is not yet very large, but quite a number of donations have been promised. The meetings are well attended and have already created great interest in electrical matters. Mr. W. F. Brown, of Monticello, Minn., thinks he is the first electric light agent to carry a practical sample of light. He has a small storage battery capable of running a 40 c. p. lamp for three hours continuous burning. It certainly makes a fine display, and is very effective, and saves a heap of talk. Mr. Brown talks of taking his battery on the lake some of these fine evenings to dazzle the poor little fishes, so that he can spear them. Great sport is expected, of which the WORLD readers may hear of later. Mr. Brown expects soon to sell his lighting plant in Monticello and make his headquarters at Minneapolis. He speaks very highly of the Heisler system in use there, and thinks series lighting is *the* thing for long distance incandescent work. The new Bernstein series lamp is, he says, quite a step ahead of their old lamp both for economy and durability.

The long-talked of idea of utilizing wind power by the aid of storage batteries for the purpose of light, heat and power, is very soon to be put to a practical test in a prominent building about to be erected in Minneapolis. A wind-mill capable of giving off 10 h. p. with a 15 mile an hour breeze will be fixed into the tower, connected to a dynamo, which will charge accumulators when the wind blows above a certain rate. A recording wind-pressure gauge and a recording voltmeter will be provided to show at any time what has been put into the batteries, and a recording ampèremeter will be connected into the circuit to show what has been taken out. The plan, as described by the projector, seems to be feasible, and its fulfillment is watched for with a good deal of interest, for why shouldn't our frigid nor'westers be turned to some account toward diminishing instead of increasing our gas and coal bills?

Messrs. Schei & Chalfant, mill owners, of Osakis, Minn., express great satisfaction with their electric light plant. They claim that Osakis is the smallest town in the world to be lighted by electric lights throughout—the mill, stores, churches, streets, and residences. The town only claims 550 inhabitants, and the plant is paying the owners well, besides lighting their mill gratis. The system in use is the Waterhouse, of Hartford, Conn., and is working very satisfactorily.

The Union Construction Company, of Minneapolis, is a newly organized concern. Their business is constructing bridges, water-works, electric light plants, sewers, railroads, etc. They have a strong corps of efficient engineers who are fully up, each in his own department. They are all active young men, and business is pushing them hard.

SEATTLE, Wash. Ter.

In the early part of 1886 there was not an incandescent central station west of the Rockies, and not over a half-dozen private incandescent plants. With one or two exceptions, there were no arc lights other than the Brush in use along the entire Pacific Slope. Now you will find arc lights in about every town of 4,000 or more people, all systems being represented; but the American and Thomson-Houston systems seem particularly popular. For incandescent work the Sawyer-Man seems to be in the lead through Montana, but in the other sections it is rare to find anything other than the Edison system.

In many sections of the West fuel is only obtainable at fabulous prices, practically prohibiting the use of steam for electric lighting; but there is hardly a town on the Pacific Slope that has not a good water-power somewhere from 1 to 15 miles of the town, hence it is evident that this is pre-eminently the land of long distance or high tension lighting—both arc and incandescent. For these reasons the use of waterfalls for motive power out here has become the rule rather than the exception, and in nearly every instance the use of a high tension or wire saving arrangement is made imperative by the distance to be overcome. So far, for the incandescent work west of the Rockies, the Edison and Heisler companies seem to be practically alone in the development of this work, and their lights can be found gleaming in nearly every little hamlet and village on the Slope. The Edison people use the ordinary 3-wire and their municipal system for street and very long distance work—this latter system for ordinary work being run at 1,200 volts, but for extreme distances it is "3-wired," giving 2,400 volts. There is a proposition on foot to utililize this last arrangement to light a certain town from a water-power 16 miles distant.

The Heisler people use a peculiarly contructed generator with a stationary armature giving out an alternating current of something over a thousand volts, running lamps in series like arc lamps; they have some very successful long distance plants in operation, and seem to stand in good favor with their patrons. The following is a list of the incandescent plants in Oregon, Washington, Idaho and British Columbia, operated from central stations:

OWNER AND PLACE.	Date installed.	Number lights.	System.
Seattle Elec. Lt. Co., Seattle, W. T.	1886	325	Edison.
Seattle Elec. Lt. Co., Seattle, W. T.	1886 Inc.	200 (mun.)	"
Seattle Elec. Lt. Co., Seattle, W. T.	1887 "	750 "	"
Seattle Elec. Lt. Co., Seattle, W. T.	1887 "	650	"
Spokane Elec. Lt. & Power Co., Spokane Falls, W. T.	1886	450	"
Spokane Elec. Lt. & Power Co., Spokane Falls, W. T.	1888	1,350 inc.	"
Morey & Hawkins, Portland, Ore.	1887	650	"
U. S. Elec. Lt. & Power Co., Portland, Ore.	1886	250	U. S.
U. S. Elec. Lt. & Power Co., Portland, Ore.	1887	1,000 inc.	"
U. S. Elec. Lt. & Power Co., Portland, Ore	1888	500 "	"
Victoria Elec. Ill. Co., Ld., Victoria, B. C	1886	450	Edison.
Victoria Elec. Ill. Co., Ld., Victoria, B. C.	1888	450 inc.	"
Vancouver Elec. Ill. Co., Ld., Vancouver, B. C.	1887	300	"
Vancouver Elec. Ill. Co., Ld., Vancouver, B. C.	1887	350 (mun.)	"
Vancouver Elec. Ill. Co., Ld., Vancouver, B. C	1888	1,000 inc.	"
Townsend Elec. Lt. Co., Port Townsend, W. T.	1887	300	"
Tacoma Lt. & Water Co	1886	200 (mun.)	"
Pendleton Elec. Lt. Co., Pendleton, Ore.	1887	300 "	"
W. S. Byers & Co., Pendleton, Ore.	1887	160	Heisler.
W. H. Halman, Salem, Ore.	1888	600	"
Eugene City Elec. Lt. Co., Eugene, Ore.	1888	320	"
Hague & Co., East Portland, Ore.	1888	160	"
Capital Elec. Lt. & Motor Co., Boisé City, Idaho	1887	450	Edison.
Brush Elec. Lt. Co., Hailey, Idaho Ter.	1887	300	Brush.

The motor business is also coming to the point in this section, quite a number being operated at most of the Edison stations and for a variety of purposes. The light company at Spokane Falls are especially making great strides in this line, utilizing their cheap and wonderful water power to good advantage in turning an honest penny with Sprague motors. The Spragues are used almost entirely out here. The new Edison station in Spokane Falls which has just been completed by Mr. S. Z. Mitchell is said to be the best fitted up and to have the cheapest power of any station on the Slope.

OGDEN, Utah.

The outlook for electrical business throughout this section is remarkably good. The Ogden Electric Light Company now has 85 arc lights and 325 isolated incandescents. The power plant is located four miles distant on the Ogden River. Parties are now treating to purchase the power plant of the Ogden Rolling Mill, which comprises a 100 h. p. turbine, for another electric light and power company. The Story Company mines, Nevada, are making surveys and plans for the purpose of transmitting 5,000 h. p. from the waters of the beautiful Lake Tahoe, through canal to Steam Boat Springs, and thence by electricity to Virginia City. They intend to use Sprague motors. Mr. J. C. Palmer, of the Western Union Company here, has been unusually busy of late, preparing for the extension of the Wheatstone system west.

VIRGINIA CITY, Neb.

The Chollar Electric Company is running 4 dynamos, and is furnishing 78 arc lights in all. Up to the present time no effort has been made to sell electric power, but the Chollar Company is now making preparations to try electric motors in its mill.

ENGLISH NOTES.

LONDON, April 25, 1888.

Incandescent Lamp Patents.

The long-pending law-suit of the Edison-Swan Electric Lighting Company versus Holland and others came before Mr. Justice Kay in the Chancery Court on Tuesday. The defendant Holland is merely a user of the Victoria incandescent lamp, and the real defendants are the Anglo-American Brush Corporation, who manufacture the lamp in question, and who claim priority over the Edison-Swan patents upon the basis of an earlier specification filed by Lane-Fox. The Edison-Swan Company base their claim upon Edison's English patent No. 4,576 (1879), and Cheesborough's patent No. 4,847 (1878). They have already maintained priority in actions brought against Messrs. Woodhouse and Rawson and against Messrs. Shippey Bros., but the claims of Lane-Fox have never as yet been adjudicated upon. After the opening speech by the Attorney-General, setting forth the case for the plaintiffs, Sir Frederick Bramwell, F. R. S., was placed in the witness-box. His evidence went to show that in his opinion no commercially successful incandescent lamp had been in use prior to the date of Edison's patent; he admitted that Lane-Fox had obtained the idea that a high resistance filament was a desideratum, and also that the use of carbon for incandescent lamp filaments had been attempted by Roberts as early as 1852, but he denied that Lane-Fox had succeeded in embodying these two ideas in a practical shape. In cross-examination he was pressed for a definition of the term "filament," which he admitted himself unable to give. He also laid stress upon the device employed by Edison for shaping the filament before carbonization. The examination and cross examination of Sir Frederick Bramwell occupied the whole of Tuesday and a portion of Wednesday morning. Dr. John Hopkinson then entered the witness-box and repeated in substance the evidence of the previous witness. He was also asked whether certain of the alternative methods mentioned by Edison, such as the formation of a filament from a mixture of lampblack and putty, or from a cotton thread smeared with lampblack, were practicable methods, and whether an ordinary workman would be able to make a successful lamp solely from the description contained in the patent. Upon these points Dr. Hopkinson replied in the affirmative. A large number of lamps of various candle powers were handed to the witness, and his attention was directed particularly to lamps of low resistance giving one or two candles, and also to some new lamps of 800 and 900 c. p., in each of which the carbon is much stouter than in lamps of medium candle-power. Witness stated that he was prepared to assert that the term "filament" was entirely applicable to all these cases, but that he was unable to draw any clear distinction in words between what is and what is not a filament. A lad named Gimingham was then placed in the box, and gave evidence that he had made certain lamps in accordance with the specification of Edison, and without any other instructions whatever. These lamps were shown in court. In one of them the filament consisted of a mixture of lampblack and tar, formed in a mould and carbonized, and in another a carbon thread smeared with lampblack had been used; in each case the result was alleged to be completely successful. In cross-examination, the witness admitted that his brother had charge of the Edison Swan factory at Ponder's End. Dr. Fleming put in the results of tests which he had carried out upon the lamps made by the previous witness. He was of opinion that it was quite possible to make a commercially successful lamp upon the basis of the lamp-black processes. A number of lamps made by the preceding witness had been tested as to duration, and proved to have an average life of 87½ hours. He was confident that, with such slight improvements in the manufacture as would readily occur, the process would become commercially valuable. At the close of Dr. Fleming's evidence, Sir Horace Davey commenced his opening speech for the defence, but he had not gone far before it became necessary to adjourn the case until yesterday (Tuesday) morning. After a further hearing, during which nothing of importance transpired, the case was again adjourned.

Banquet to Sir John Pender.

At the Hotel Métropole on Monday evening a dinner was given in honor of Sir John Pender, K. C. M. G., by the representatives of the leading telegraph companies and his personal friends. Lord Derby occupied the chair, and the following were among those present: Archbishop of York, General Viscount Wolseley, Admiral Sir H. Keppel, Sir James Anderson, His Excellency Count Piper, His Excellency Count Van Bylandt, Marquis of Tweeddale, Earl of Galloway, Earl of Onslow, Earl of Jersey, Earl de la Warr, Viscount Bury, M. P.; Viscount Lynnington, M. P.; Lord A. Paget, Lord Thurlow, Lord Chelmsford, Lord Claud Hamilton, M. P.; Lord Esher (Master of the Rolls); Right Hon. Cecil Raikes, M. P. (Postmaster-General); Right Hon. H. Childers, M. P.; Sir Lyon Playfair, M. P.; Hon. Wm. Broderick, M. P.; Sir John Pope Hennessy, Sir Graham Berry, Sir Daniel Cooper, Bart.; W. H. Preece, Esq.; Latimer Clark, Esq.; E. Graves, Esq.; A. Siemens, Esq.; Professor Ayrton, etc., etc. It should be added that Sir James Anderson acted as Chairman of the Reception Committee. After the usual loyal toasts had been honored, General Lord Wolseley, responding to the toast of the army, navy and volunteer forces, expressed the gratitude which the soldiers and sailors felt for the repeated acts of kindness on the part of Sir John Pender, by which, when sick or wounded, they had been able to communicate with their friends at home without expense.

Lord Derby, in proposing the toast of the evening, spoke in the warmest and most appreciative terms of the leading incidents in Sir John Pender's career, bearing testimony not only to his public services in connection with submarine cables, but also the liberal hospitality, the encouragement and support of science and art, and the inauguration of industrial enterprise for which Sir John is so highly esteemed among those who know him best. Lord Derby concluded by asking the guests to drink the health of the man "to whom more than to any other we owe the present development of the telegraphic system of the world."

Sir John Fender, after expressing his gratification at gathering of so many of his old friends, said that he had been associated with a band of honorable and earnest men to accomplish a great work. The cables already put down would girdle the world five times over, and nine-tenths of the whole had been laid by private

enterprise. Sir John concluded a very striking and able speech in the following words: "Let me say that I believe when the history of the Victorian era is written, submarine telegraphy will take a very important position in its record, and those friends who are associated with us—friends in England, friends in Germany, friends in America—will all have the satisfaction that they have taken part in a work which has carried on the progress of the world, and they will feel satisfied that in taking part in that work they will have left the world more advanced and more in harmony than they found it."

The Battle of the Transformers.

The discussion upon Mr. Crompton's paper on "Transformers vs. Accumulators for Central Station Lighting" was resumed at a special meeting of the Society of Telegraph Engineers, held on Thursday evening last. Mr. Preece, continuing his speech, commenced at the previous meeting, laid stress on the fact that the three great arguments in favor of batteries were: Convenience of storage, utilization of current for motor purposes and relative smallness of engine plant. Against these had to be set the fact of the smaller cost in the transformer system, both for transformers and for distributing mains, and also the undoubted fact of the higher efficiency of that system. While still keeping his mind open on the subject, he (Mr. Preece), for the present, gave his opinion in favor of secondary generators. Sir David Salomons, from independent inquiries of his own, confirmed Mr. Crompton's figures with regard to the cost of batteries; he thought the efficiency might be taken between 60 and 70 per cent. He laid stress upon the necessity of invariably employing batteries in two separate parallels, in order to be absolutely secure against a breakdown. His own experience was that whatever material battery boxes were made of, they were liable at times to get broken and run dry. For this reason he did not consider any battery system secure, unless two separate batteries were supplied. Mr. Crompton next spoke, as he would not have an opportunity of replying at the close of the debate. He exhibited a switch which was in use at Kensington Court for the purpose of regulation, the principle being that a certain number of cells could be placed either in series with each other or in different sets of parallel among themselves and then in series with the rest of the battery. By means of hand regulation in this way it was easy to maintain the E. M. F. upon the mains constant. Mr. Swinburne exhibited a diagram of the method by which he proposed to prevent alternating machines, connected in parallel, from getting out of step. He thought that the problem of running alternate current motors could be solved by the use of a choking coil with a movable core; if the motor tended to fall out of synchronism the current would increase, the core would be pulled down, more self-induction would be thrown into the circuit and the speed of the motor would increase. He believed in that way they could make a motor that would work fairly well with large differences of load. Mr. Crompton's difficulty, he thought, would arise from the introduction of 400 or 500 volts upon the consumer's premises; he was afraid that would be a great drawback. As to accumulators, he did not know quite what to say; he would rather like to quote Mr. Mordey's dictum "that the great advantage of an alternate current system arises from the fact that you cannot use batteries with it." He also remarked upon the superior efficiency of an alternating over continuous-current machines, and he believed that eventually they would be very much cheaper. He was inclined at the present time to look for a final solution, neither to batteries nor to transformers, but rather to motor generators, which he thought had hitherto been too much neglected. General Webber did not believe that Mr. Crompton's system of subways could possibly prove satisfactory; he had had much experience in underground work, and he knew the impossibility of keeping a subway of this description free from dirt and moisture. He also criticised Mr. Crompton's estimate for insulated cables, which he thought was much too high. Mr. Hammond expressed very considerable surprise that Mr. Crompton should have spoken of the Brighton and Eastbourne installations as "confessedly temporary ones, run purely for advertising purposes;" he thought that it was well known that these stations had been in existence for over five years, and had paid dividends of 5 per cent. His two years' experience of transformers at Eastbourne and his experience of secondary batteries at Brighton led him unhesitatingly to proclaim himself an advocate of transformers. At Brighton they were now changing from a multiple series to a transformer system. They had two or three small battery stations charged upon the multiple series mains and their experience with regard to efficiency was that it certainly did not exceed 60 per cent. Mr. Hammond went on to criticise other portions of Mr. Crompton's paper in detail, and pointed out that the actual experience of transformer working which has been gained at Eastbourne was of a very different character from that imagined by Mr. Crompton.

Lord Thurlow's Lighting Bill.

This bill came before the Committee of the House of Lords on Monday last, where an amendment was carried, excluding the consideration of good will where the works were purchased by the local authorities. Lord Thurlow said that all the leading electric light companies were prepared to accept the omission of these words. The Marquis of Salisbury remarked that in that case, seeing that the companies ought to know their own business best, he would not object to the words being struck out, although for his own part he should have been prepared to support their inclusion, and in any case he would reserve the right to vote at any future time for their introduction. Lord Thurlow's remark is somewhat of a puzzle, and it would be interesting to know what authority he had for his statement. I can safely say that several of the most important companies entirely dissent from the noble lord on this point. Possibly, however, no great harm will be done; for, according to a recent decision in the law courts, the term "market value" may be held to include "good will," and if the former term be used instead of the latter, the bill will meet with less opposition from the Radicals when it gets into the House of Commons.

The Maxim-Weston Electric Company.

Following the example of the shareholders of the Pilsen-Joel Company, the shareholders of the Maxim Weston Company have recently appointed a Committee of Investigation into the management of their affairs. The report is now to hand, and it discloses a state of things very similar to that made public in the case of the Pilsen-Joel Company. The committee reports great difficulty in obtaining information, and informs the shareholders that the profit shown in the last balance sheet was only arrived at by omitting to make any allowance for bad debts, and by unwarrantably writing up the stock and patents of the company. It seems also that, although Mr. Hugh Watt, M. P., asserts that the Watt dynamo, arc lamp and incandescent lamp patents are *not* the property of the company, the energies of the officials and workmen at the factory have been mainly employed to develop and perfect the Watt patents. The committee concludes by venturing to suggest a radical reorganization of the Board and a more efficient manner of carrying on business.

THE TELEGRAPH.

Knoxville, Tenn.—The Gaynor Electric Co., of Louisville, Ky., have contracted to put in a fire-alarm system.

T. M. B. A.—Assessment No. 217 has been made for $1 to meet the death claims of W. H. Hamlin, J. J. Flanagan and A. M. Paddock.

Birmingham, Ala.—The Southern District Telegraph and Electric Company has been organized by E. W. Linn and others, with a capital stock of $40,000.

Atlanta, Ga.—The American District Messenger and Electrical Supply Company has been formed by J. M. Stephens and others, with a capital stock of $10,000.

Western Union Annexation.—Chicago advices say that the Western Union Company has made a contract with the St. Paul road whereby it secures control of 1,900 miles of wires, including over 200 offices in Iowa, Nebraska, Minnesota and Dakota.

Western Union Taxes.—An opinion was filed by Judge Simonton on April 30, at Harrisburg, in the Commonwealth's suit against the Western Union Telegraph Company involving a tax on gross receipts for messages sent into, out of, or through the State. The case was argued about a year ago and Judge Simonton then delivered an opinion in which, upon the authority of a decision of the Supreme Court of the United States, rendered in 1872, in the case of the Philadelphia & Reading Railroad Company, he decided that the Western Union was liable for tax to the amount of $23,296. M. E. Olmstead, counsel for the company, filed exceptions to the opinion, and to-day's opinion is upon the exceptions. Holding that the Supreme Court of the United States has in two recent cases reversed its former decision, Judge Simonton finds himself compelled in deference to that court to reverse his own former opinion and decide against the State.

Both Parties Want Damages.—The Western Union Telegraph Company has filed a libel for $60,789 in the United States District Court against the Inman line steamship "City of Richmond." The action is brought to recover damages sustained by the telegraph company, by reason of the steamship's wheel injuring twelve cables extending from Cortlandt street to Jersey City on the river bed. The accident occurred on Aug. 19, 1887, while the "City of Richmond" was landing at the Inman wharf. The cables were all broken, and remained inoperative for sixteen days. The Western Union asks for $10,789 for repairing its wires, and $50,000 for loss sustained by reason of its inability to transmit messages. Some time ago the Inman Company brought an action for $2,000 against the Western Union Company for replacing the "City of Richmond's" screw, which was broken by contact with the cables.

THE TELEPHONE.

Charleston, S. C., is to have a Gamewell police telephone and telegraph system at a cost of $12,650.

New England.—The March quarter earnings of the New England Company are $266,328, and the expenses $190,334.

Cleveland, O.—It has been decided by the city council not to enforce any underground telephone ordinances for the present.

Overhead Wires.—At Albany on May 4 the bill introduced by Mr. Cromwell in the Assembly, to prohibit the stringing of telephone and electric light wires less than 10 feet apart, was favorably reported.

N. T. E. A.—The office of General Barney, secretary of the National Telephone Exchange Association, is now located in Room 512 of the Metropolitan Telephone Company's building in Cortlandt street. The treasurer's office is in Room 501 of the same building.

THE ELECTRIC LIGHT.

Orono, Me., is to have an electric light plant.

University Place, Ga., will have electric lighting.

St. Albans, Vt., has voted strongly in favor of electric lighting.

Orlando, Fla.—The Orlando Gas Company proposes to put in an electric light plant.

Catlettsburg, Ky.—The Indianapolis Jenney Company will put in the proposed plant.

Oldtown, Me., is to have a large new cotton mill, which will be fitted up with electric lights.

Buenos Ayres.—A large new park just opened in Buenos Ayres is to have the electric light.

Dyersburg, Tenn.—The Dyersburg Oil & Fertilizer Co. contemplate putting in electric light machinery.

Louisville, Ky.—The 800-light plant at Phœnix Park is to be put in by the Gaynor Electric Supply Company.

Boston, Mass.—The table factory of Bandwell & Anderson at East Boston is to have a small electric light plant.

Frederick, Md.—The cost of the plant purchased by the city from the Thomson-Houston Company is $14,500.

Columbus, O.—The Conneaut Electric Lighting Company has been incorporated with a capital stock of $10,000.

Wichita, Kan.—The Wichita Incandescent Light Company has been incorporated with a capital stock of $50,000.

Xenia, O., has obtained permission from the State Legislature to borrow $6000 for electric lighting improvements.

Gereham, N. H., has appointed a committee, under Mr. W. Noyes, to investigate with the object of putting in electric lights.

New Bedford, Mass.—The Triumph Heat and Light Company has been formed at New Bedford. Mr. E. Rodman is president.

Chicago.—The new United States Express Building in Chicago, is now being fitted up with an Edison installation of 500 lights.

Fairmont, W. Va.—The Montana Coal & Coke Company will put in electric lights, and will adopt electric motors for haulage.

Wheeling, W. Va.—The appropriation of the Board of Gas Trustees for the purchase of an electric light plant will reach $23,000.

Atchison, Kan.—The Atchison Gas, Electric Light and Power Company has been incorporated with a capital stock of $300,000.

North Andover, Mass.—The Davis & Furber Machine Company are to put in a Loomis incandescent plant in their new card clothing factory.

New York City.—The Electric Light and Supply Company of New York has been incorporated by A. R. Tong and others, with a capital stock of $10,000.

Rockaway, L. I.—Mr. McLean, Edison agent, has secured the contract for a complete Edison plant of 300 lights for the new Hotel Averne, near Rockaway.

Pontiac, Mich.—The Edison Electric Light and Motor Power Company of Pontiac has been incorporated by A. Perry and others, with a capital stock of $12,000.

Fall River, Mass.—The Edison station at Fall River is again in full operation, the suspension owing to the fire having been but a day or two, owing to the activity shown.

Salt Lake City.—The capacity of the electric light company at Salt Lake City is now 200 arcs and 400 incandescents, and the company is making active preparations to furnish power.

Somerville, Mass.—The Somerville Electric Light Company has recently ordered another engine of the Armington & Sims type, rating 90 h. p. The engine is being set up and will soon be ready for the lighting.

Washington, D. C.—Tenders of from $100,000 to $130,000 have been made for a plant for the Capitol by the United States and Sawyer-Man parent companies, and by the local United States Company.

Tyler, Tex.—Proposals for manufacturing and putting in the gas and electric light fixtures for the government building at Tyler, Tex., will be received until May 11 by C. S. Fairchild, Washington, D. C.

St. Louis, Mo.—Mr. F. W. Horne, the Western manager of the Excelsior Electric Company, visited St. Louis last week, and secured a contract for the new building of the Library Association for 100 arc lights.

Quincy, Ill.—The beautiful grounds of the new Illinois Soldiers and Sailors' Home will be lighted by electricity, the service being furnished by the local Thomson-Houston Electric Light and Power Company, A. B. Faunce, manager.

Albany, Ore.—The local *Democrat* records the successful going into operation there of a Schuyler plant of 17 arc lights, put in by Mr. Allen, together with a large number of Heisler incandescents. The demand for both kinds of light is very brisk.

Montezuma, Ia.—Mr. W. R. Lewis has been granted an exclusive right to establish an electric light and power plant, and he has contracted to furnish the city eight incandescent lamps of 32 candle-power each and 26 lamps of 16 candle power for the sum of $456 per year.

Providence, R. I.—The capital stock of the Ball Electric Light Company, a new organization which is to be established in Providence, has been fixed at $30,000, and the greater part is said to have already been taken. The location of the plant has not yet been decided upon, but arrangements are being made to begin operations.

Atlanta, Ga.—The Georgia Electric Light Company, which has just gotten settled in its handsome new offices in the Kimball, has decided to build a handsome new station on its grounds for the purpose of enlarging capacity. The company is booming right along and the incandescent light is growing more and more popular with our people every day.—*Atlanta Ex.*

Halifax, N. S.—A special dispatch from Halifax says: Another electric light patrolman, George Crocker, was killed last night on the same post on which Webber was killed on Sunday night. He went up a post and threw one of his legs over a crosspiece, when it must have come in contact with the wire. He then clutched the wire with his hands and was killed instantly.

Danvers, Mass.—A special dispatch from Danvers says: An adjourned special town meeting has voted to establish an electric light plant in Middleton. It was voted to issue ten notes for $1,500 each, one to be payable each year at a rate of interest not to average over four and one-half per cent., and $500 more was voted to maintain the plant for one year, in addition to the $2,000 previously appropriated.

Friendship, N. Y.—The Enterprise Electric Company has closed contracts with the Pancoast Coal Company, of Scranton Pa., for a plant of 150 incandescent lights to be installed in its mines and stores. The company has also made contracts with the Buffalo Hardware Company, of Buffalo, N. Y., for a 400 incandescent light plant to be installed in Austin, Potter Co., Pa., and it has orders for 300 lights in New England.

The Hell Gate Tower.—The Hell Gate electric light tower was sold at Government auction last week for $125. The tower

was erected about two years ago at a cost of about $15,000. The light was said to be not a success. Mariners found it cast shadows along the surface of the water in the neighborhood of the tower which were dangerous to vessels. The purchaser is mentioned in the newspaper as Mr. Westminster Abbey.

Walla Walla, W. T.—The territorial prison at Walla Walla is to put in an Edison plant this summer. Mr. Mitchell, of Seattle, visited Walla Walla recently and effected arrangements with the gas company to put in a plant for furnishing lights to the city. The prospects are that there will be a brisk electric light business throughout the Territory this year. Nearly all the important places have adopted the electric light, or are about to do so.

Collins, Col.—The Collins electrical plart, operated by Roberts & Stewart, lessees, consists of one 45 Western Electric arc machine and one 250 incandescent light machine. The Episcopal church has arc lights and the Presbyterian has two groups of incandescents on the arc circuit. The people are well pleased with the light. Mr. E. P. Roberts, of this plant, is also the active and well-known manager of the Brush-Swan Electric Light Company, at Cheyenne.

Westfield, Mass.—The Springfield *Republican* says: With the absorption of the Westfield (Mass.) electric light plant by the gas company, come plans for considerably increasing the capacity to furnish electricity for lighting purposes. The present electrical building on Orange street will be given up, and a brick building, 40 × 100 feet, will be erected near the gashouse, giving room for dynamos and boilers that will run four times the number of arc and incandescent lamps now in use.

Lawrence, Kan.—A new electric light company has been organized at Lawrence, Kan., in which J. D. Bowersock is the leading stockholder. A plant will be established at a cost of not less than $30,000. It will include two engines of 200 h. p. each, and have a dynamo capacity of 70 arc and 1,000 alternating incandescent lights. The Thomson-Houston system will be used. The electric light plant of Pierson Bros., in the city, is also to be greatly increased and the service improved.

Dover, N. H.—The Dover Electric Light Company, under the management of Mr. H. W. Burgett, has had a most remarkable growth for a plant installed for so short a time. Since the formal opening, a few months since, at which time there were two engines in duty, the increase in the demand for the electric lights has compelled the company to add another 60 h. p. engine, which is now loaded to its capacity and will necessitate the addition a large engine of 150 h. p. The station will also be enlarged and another boiler of 150 h. p. added.

Chester, Pa.—The Chester Electric Light, Heat and Power Company, having successfully filling two of the essentials set forth in the company's charter, are now making a canvass of the vicinity of their works for subscribers to a steam-heating service, which they propose to inaugurate if it will seem to pay. To do this it is proposed to place steam radiators in dwellings and business houses, and communicate the steam by means of underground piping, quite a novelty here, and we don't see why it is not feasible, nor why it may not be desirable and profitable.—*Chester (Pa.) News.*

New York City.—Vice-President Dowling, of the Board of Aldermen, has offered a resolution providing that hereafter each lineman, patrolman or person handling electric wires or lamps in the streets of the city shall wear conspicuously displayed a badge bearing the name of the company by whom he is employed, such badge to be numbered and to be furnished by the company. Persons violating this ordinance shall be guilty of a misdemeanor and punishable by fine and imprisonment. Mr. Dowling said that this was a most important matter in view of the number of accidents that had occurred lately from electric wires. The Committee on Public Works, to whom the matter was referred, was requested to report at the next meeting of the board.

"Globe Gas Light" System vs. Electric Light.—A dispatch from Middleborough, Mass., dated April 28, runs as follows: "At the town meeting, held April 14, an appropriation of $1,650 was made to light the town by the Globe gaslight system. A committe was chosen to arrange details. An agent of the company present said he would begin work the present week. He came prepared to begin, but was told by the committee that they had rescinded their action and could not designate the position of lights. They considered introducing electricity, moreover. He said that he would then place the lights himself. In the meantime another town meeting had been held, and electricity had been decided upon. The agent insisted that the town's original approbation was a binding contract, and he should so consider it. His men were threatened with arrest if they began work. The case will necessarily go to the courts for settlement."

APPLICATIONS OF POWER.

Oswosso, Mich.—Work is in hand for an electric road.

Sacramento, Cal.—The electric road is now being built and will be ready by July.

Lima, O.—The Silvey Electric Works are building a motor for street cars, and will run one on a local road.

Anniston, Ala.—Cars have been ordered for the electric road at Anniston, and the line will be running, it is said, by June.

Nashville, Tenn.—The McGavock & Mt. Vernon Railway Company has now applied for permission to use electric motors or dummy engines.

San Jose, Cal.—Owing, it is said, to the insufficiency of the power plant, the electric road is not yet in successful operation. A larger dynamo is to be put in.

San Rafael, Cal.—Dr. Euphrat, of San Francisco, has applied for a street railway franchise for 50 years, the road to be operated by electricity on his system.

Huntington, W. Va.—Mr. J. L. Young is to build an electric road 3¼ miles long, with centre rail for current. He has contracted to have it ready by July 1.

Modesto, Cal.—A franchise for a street railroad to be operated by electricity, cable or other such power has been granted to F. A. Crossey, F. W. Fulkoch and others.

Parkersburg, W. Va.—The Park City Street Railroad Company, with a twenty-five years franchise, has permission to use any means of traction except steam motors.

Sault Ste. Marie, Mich.—An electric road is to be built at Sault Ste. Marie by the Detroit Electrical Works, under contract to be ready by July 1. Two miles will be put in operation.

Big Stone Gap, Va.—The Big Stone Gap Improvement Company proposes to put in an electric road as well as an electric light plant. The road will be a belt line extending, when complete, about four miles up and down the valley, and storage batteries are to be used.

Smithwood, Tenn.—The Knoxville & Fountain Head Railroad—an English enterprise represented by C. K. McCallum—is surveying for a standard gauge road to connect with the Knoxville & Ohio Railroad. It will be 3½ miles long and will operate by electricity.

Rockford, Ill.—The Electric Power Company, of Rockford, is putting in a 100 h. p. plant, and has rented 60 h. p. The street railway is also likely to use electric power. Mr. J. W. Bartlett is president of the company, and Mr. A. L. Bartlett, secretary and treasurer.

Memphis, Tenn.—The Memphis & Ft. Pickering Street Railway Company has been incorporated for the purpose of constructing a street railroad in the city of Memphis, by L. Hanauer, I. Katzenberg, M. Gavin, G. V. Rambaut and D. E. Meyers. Steam, cable, animal or electrical power may be used.

Keen Foresight.—Mr. T. W. Harris says: In my opinion electricity will inside of twenty years move ninety per cent. of the street cars in the United States, but animal and cable power have their places, and I do not look to see cable power outdone in its own particular sphere.

Hudson, N. Y.—The Hudson Electric Railway Company has been incorporated by H. McGonegal, S. D. Lake and others, of Syracuse, and E. J. Hodge and A. J. Bowles, of Hudson, with a capital stock of $50,000, to run a road between Hudson and Stottville, five miles in length.

Oakland, Cal.—A recent accident to its boiler, led the Oakland *Times* to look into the subject of electricity, and it has now had installed for it by the Oakland Electric Light and Motor Company a Keith motor to drive its presses. It is the first paper on the Pacific Slope to "print by lightning."

Sprague Motors in Boston.—Sawyer & Blake, the New England agents of the Sprague Motor Company, report recent installations of no less than 75 h. p. of Sprague motors in Boston, for running sewing machines, lathes, ice cream freezers, coffee machinery, printing presses, elevators and rope hoists.

Rochester, N. Y.—The electrical railway between Rochester and Charlotte will be commenced shortly and the work of construction will be pushed forward. It is expected that the road will be completed next fall. Cars will be drawn by horses over a portion of the line until the work is finished. Contracts for three bridges have been awarded to the Rochester Bridge and Iron Works.—*St. Ry. Jour.*

News From Hoboken.—Dr. Pitts and wife and child arrived home from Richmond, Va., on Thursday night, where they have been visiting. The Doctor enjoyed his stay in Richmond exceedingly, and says that the thing which most impressed him was the electric street railroad. They run by cable which is attached to the cars on top and work smoothly and easily. They ascend and descend a hill with the same even speed.—*Hoboken Advr.*

The Electrical Heat and Power Company of the United States was organized at Harper's Ferry, Va., on Saturday, the 28th ult., with Pittsburgh capitalists at its head. The capital stock of the company is $600,000. C. H. Jackson, vice-president of the Union Switch and Signal Company, is president of the new corporation, and George W. Wilson treasurer. The Pittsburghers on the board of directors are James M. Guffey, C. H. Jackson, James Atwell and James M. Humbert. The principal office will be in Washington, and the first plant will be erected in that city.

The New Daft Factory.—The Daft Company is to move its works to Marion, N. J., in order to secure facilities for its rapidly growing business. It has purchased there a very large glass and iron building, three stories high and 200 feet front, close to the railway. At its rear is another brick building of three stories. The whole will give a floor space of 85,000 square feet. It is the intention of the company to make this the leading electrical manufacturing establishment of its kind in America, and, therefore, in the world. The building will be equipped with new machinery, and will have every facility for turning out apparatus as fast as called for. The present large steam power is to be increased. The grounds are also extensive, and furnish ample room for the exhibition of electric cars.

PERSONALS.

Mr. G. B. Prescott, Jr., has entered into an arrangement with the Electrical Accumulator Company, as electrician, and will have his office at the headquarters of the company.

Prof. R. H. Thurston has contributed to the *Forum* an interesting article on "Steam and its Rivals." It is an admirable discussion of the subject, and naturally includes electricity within its survey.

Mr. Schuyler S. Wheeler has been appointed electrical examiner of the State Civil Service Board. He has lately resigned from the C. & C. Motor Company to engage in a professional partnership with Mr. F. B. Crocker. His recent *Harper's Weekly* article on electrical development has had the honor of being copied verbatim in the *Illustrated London News*, and has thus had an enormous circulation.

Mr. Walter K. Freeman, who is well known in New York electrical circles, has just come out with some startling circulars in which he lays claim broadly not only to the incandescent lamp but the alternating system. He has begun work in the courts, and states that he is in the arena for a fight to the end. He promises some more literature on the subject, and those who are interested may perhaps deem it worth while to see what he has to say.

Dr. Otto A. Moses, with the aid of the electric light, has been able to penetrate the mysteries of the Shakespearean cryptogram. He has studied the subject for some years, and at a meeting of the Philokalia Society, held at the Hotel Brunswick, on May 5, identified Bacon not only with Shakespeare but with John Webster, the reputed author of the play, "The Duchess of Malfi." It need not be said that the Doctor's reasoning on the subject is highly ingenious. Webster he regards as Shakespeare's successor in Bacon's nom de plumeship.

Mr. H. C. Adams, who has for some time been the treasurer and factory manager of the American Electric Manufacturing Company, was this week elected president and general manager of the company, in place of Edwards H. Goff, resigned. A syndicate of strong capitalists have acquired a large interest in the American Company, with a view to enlarging and developing its business to the fullest extent possible. The "American System" of electric lighting has now been introduced into every State in the Union, as well as all foreign countries, and has acquired a reputation for being the best arc light system on the market. With the new element of capital which has come into the company, and the vigorous management which has been instituted to carry out the plans and purposes of the company, inaugurated by Mr. Goff, the company will be put in first class financial condition, and will push its business to the utmost extent.—*N. Y. Graphic.*

Dr. L. Younghusband, of Detroit, uses in his practice a large Toepler-Holtz machine, with modification and improvements by himself. This machine gives an exceedingly small current, but of a very high electromotive force. It operates equally well in all temperatures. It is so powerful that the patient, while on the insulated platform, becomes completely charged, and while so charged sparks from 10 to 12 inches long are drawn out. There is no pain or risk attending this treatment, but, on the contrary, the sensations are most pleasing, and especially in view of the fact that ozone in immense quantities is given off. Every person taking a treatment as administered by the doctor goes away with new life. This machine can be taken apart, cleaned and set up in ten minutes. The doctor is a regular physician, having a large practice. He has made a special study of electricity in its application to the healing art, but is, however, a thorough believer in the code of medical ethics, so much so that neither THE ELECTRICAL WORLD nor any power can induce him to advertise.

MISCELLANEOUS NOTES.

Louisville, Ky.—The Indiana Electric Service Co., capital stock $100,000, has been organized at Louisville with John T. Gathwright as president. The company will operate in Indiana.

Minneapolis, Minn.—The National Subway Company's Dorsett system is, it is stated, to be put in this summer. The work will occupy about seven months, and will cost from $20,000 to $25,000 per mile.

A Change of Base.—A move from Philadelphia to New York has been made by the *Progressive Age*, a journal which, while devoted to gas interests, has always been fair and appreciative in its treatment of electric lighting. It reaches us in a new cover and with a handsome new make up. It will henceforth be under the direction of Mr. E. C. Brown and the editorship of Mr. F. R. Sprague, and promises to enjoy greater influence and prosperity than ever.

Worcester, Mass.—The work on the new Salisbury laboratory is now being pushed forward with great vigor. It will be remembered that Mr. Salisbury gave $100,000 for the construction and equipment of this building about a year ago. In this laboratory very extensive preparations are being made for work in electrical engineering, which will be under the direction of Prof. Kimball. The electrical laboratory will be 63 by 24 feet. The small magnetic laboratory near the southeast entrance to the Institute grounds will be used in connection with the electric department, and will contain accurate standard instruments for electrical and magnetic measurements.

BUSINESS NOTICES.

Frames of every description for showcards and pictures can be had of William Levin, 37 Dey street. Quality and promptness guaranteed. Catalogue and estimates on application. A full line of elegant pictures low, for cash.

The Pond Engineering Company, of St. Louis, has just issued its revised and enlarged catalogue for 1888. It contains much valuable data on steam and hydraulic engineering, and should be in the hands of all interested in steam plants.

The Partz Electric Battery Company, of 1,723 Chestnut street, Philadelphia, have three batteries which they make a specialty of, namely, a motor, acid gravity and open circuit. Send for their catalogue. The results of three years' use are simply marvelous.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Hine & Robertson, 45 Cortlandt st., N. Y., are pursuing a novel method of inducing electric light companies to try "Eureka" Packing. To every new customer ordering direct from them 15 pounds or more at regular price, 75 cents per pound, they will send a handsome 8-day calendar clock, 12 in. dial, 24 in. high, or set

of brass oilers and tray, 6 pieces, best made. This is an easy way to secure one of these necessary articles and get a packing indorsed by the most prominent electric light plants.

Hering's Principles of Dynamo-Electric Machines.—"'Hering's Principles of Dynamo-Electric Machines' is just the work I wanted. I think it is undoubtedly one of the most useful and practical books on electric lighting machines ever published, and should be in the hands of every electrician or any person very much interested in electric lighting. We feel very thankful to Mr. Hering and yourself for its publication."

W. O. COLEMAN,
Civil and Mechanical Engineer, West Point, Miss.

Hering's Principles of Dynamo-Electric Machines.—"I feel assured that 'Hering's Principles of Dynamo-Electric Machines' will prove a decided help, particularly to students of electrical engineering who are designing and constructing dynamo machinery for experimental and testing purposes, and who need practical rules. I shall use it with 'Thompson's Dynamo-Electric Machinery' for our second year students in the electrical engineering course here."

L. I. BLAKE, Prof. of Physics,
University of Kansas, Lawrence, Kans.

Boiler Coverings.—Shields & Brown Company, manufacturers of sectional insulated air coverings for boilers, steam, gas and water pipes, 240 and 242 E. Randolph street, Chicago, report that their spring trade is considerably in excess of previous years, and that prospects for the summer are most encouraging. With the advantage of large manufacturing facilities and increased storage room at their new premises they expect to double their business during 1888 over former years. They are constantly adding new features and improvements to their line of goods, and are known as one of the most enterprising and aggressive houses in the trade.

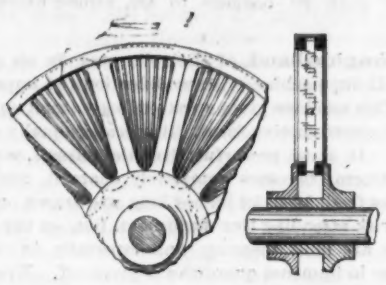
Feed-Water Heaters.—The Wainwright Manufacturing Company, of Boston, report the following recent shipments of their corrugated tube feed-water heaters: Four to Boston, two to Lowell, and one each to Springfield, Worcester, Lynn, Taunton, New Bedford, Huntington, Medway, Spencer and East Braintree, Mass.; one each to Portland and Eastport, Me.; one each to Putnam and New Britain, Conn.; one to Providence, R. I.; twelve to New York City; one each to Paterson, Hackettstown, Nyack and Union Hill, N. J.; one to Cedar Rapids, Pa.; one each to Cleveland, East Liverpool and Salem, O.; one to Chicago, Ill.; one to Lake City, Fla.; and one to Montreal, Can. The company also report a large number of unfilled orders on hand, with every prospect of a busy season.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MAY 1, 1888.

381,907. Pneumatic Railway and Conveyer; Thomas A. Connolly and Anthony A. Connolly, of Washington, D. C. Application filed June 25, 1881. A pneumatic tube is arranged in close proximity to a railway. A metallic piston propelled by air runs in the tube and acts as an armature for an electro magnet located upon a vehicle. The attraction between the magnet and armature or piston causes the car to be moved along with the piston.

381,915. Electric Lighting Apparatus for Railroad Cars; Henry E. Dey, New York, N. Y. Application filed Jan. 10, 1888. A dynamo is geared to the car axle, and is



382,174. ARMATURE FOR DYNAMO ELECTRIC MACHINE.

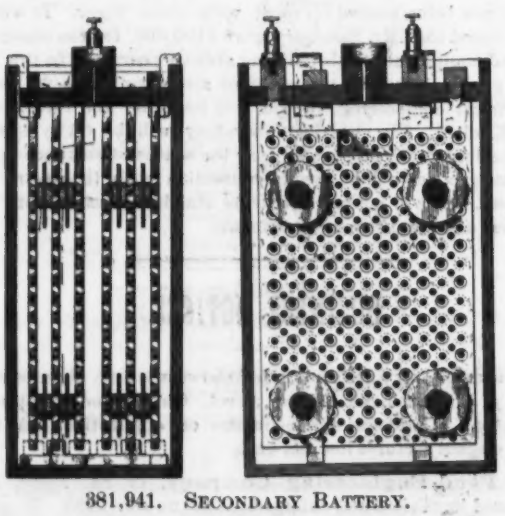
used to charge a secondary battery on the train. The invention consists in the manner of mounting the generator.

381,921. Adjustable Nipple for Incandescent Electric Lamps; Emil F. Gennert, Brooklyn, N. Y. Application filed Dec. 2, 1887. A flexible joint between the lamp socket and the nipple having a passage through both parts of the same to accommodate the electric wires. See illustration.

381,938. System of Telephonic Intercommunication; John A. McCoy, of Medford, Mass. Application filed July 6, 1887. Connecting apparatus for automatic telephone exchanges, comprising a series of discs, one for each line, carried upon a single rotating shaft, a series of rotating arms normally engaged with said discs, and rotating therewith, each of the arms constituting the terminal of a telephone line, a series of lifting rods, one for each line and connected by branch circuit with the line, disposed around the central shaft and provided with projecting arms equal in number to the number of discs, and a single electro-magnet controlling each of the lifting rods and adapted, when energized, to move the rod longitudinally, whereby the rotating line terminal at the time opposite any one of the projecting arms of the said rod may be engaged, lifted from its disc engagement, and electrically connected with the line represented by said lifting rod.

381,941. Secondary Battery; Abraham V. Meserole, New York, N. Y. Application filed November 25, 1887. The plates of the battery are provided with funnel shaped holes which flare in opposite directions. See illustration.

381,953. Electric Pen Holder; Chas. W. Reitter, of Denver, Col., application filed July 19, 1887. Plates of copper and zinc are placed on each side of the lower end of a pen holder.



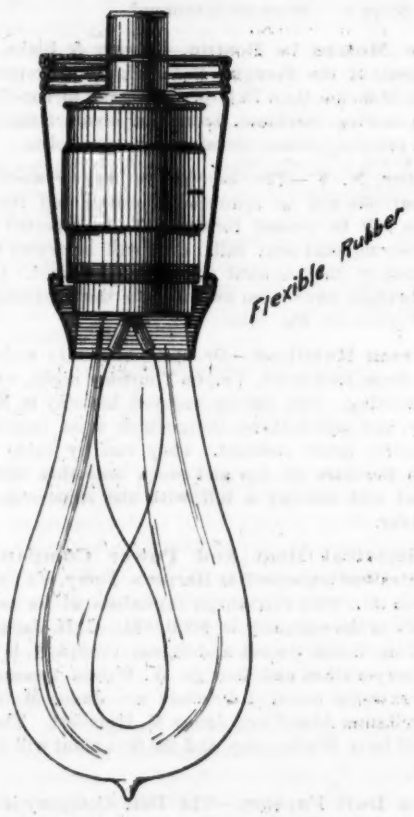
381,941. SECONDARY BATTERY.

They are connected together by means of a rivet but are insulated from the pen holder itself. The invention is designed to prevent and cure "writer's cramp."

(1) 381,968. (2) 381,969. (3) 381,970. (4) 382,279. (5) 382,280. (6) 382,281. (7) 382,282. (1) Electro-Magnetic Motor; (2) Electro-Magnetic Motor; (3) System of Electrical Distribution; (4) Electro-Magnetic Motor; (5) Electrical Transmission of Power; (6) Electrical Transmission of Power; and (7) Method of Converting and Distributing Electric Currents; Nikola Tesla, of New York, N. Y., Assignor of one-half of Nos. 1, 2, 3, and 4 to Charles F. Peck, of Englewood, N. J. Applications filed respectively Oct. 12, 1887; Nov. 30, 1887; Dec. 23, 1887; Nov. 30, 1887; Oct. 12, 1887; Nov. 30, 1887; and Dec. 23, 1887. In carrying out these inventions there are provided a series of inducing-coils and corresponding induced coils, which, by preference, are wound upon a core closed upon itself—such as an annulus or ring subdivided in the usual manner. The two sets of coils are wound side by side or superposed or otherwise placed in well-known ways to bring them into the most effective relations to one another and to the core. The inducing or primary coils wound on the core are divided into pairs or sets by the proper electrical connections, so that while the coils of one pair or set tend to co-operate in fixing the magnetic poles of the core at two given diametrically opposite points, the coils of the other pair or set—assuming, for sake of illustration, that there are but two—tend to fix the poles ninety degrees from such points. With this induction device is used an alternating current generator with coils or sets of coils to correspond with those of the converter, and by means of suitable conductors are connected up in independent circuits the corresponding coils of the generator and converter. It results from this that the different electrical phases in the generator are attended by corresponding magnetic changes in the converter; or, in other words, that as the generator-coils revolve the points of greatest magnetic intensity in the converter will be progressively shifted or whirled around. This principle is applied under variously modified conditions to the operation of electro-magnetic motors. See illustration.

(1) 381,992. (2) 381,993. Watchman's Time Indicators; Geo. B. Fessenden, Boston, Mass. Applications filed respectively June 26, 1884, and Dec. 22, 1886. In a watchman's time detector apparatus a series of branch circuits leading from a receiving station to different stations to be visited, and a return wire, common to several of said stations, combined with a generator of electricity, connected in circuit with the branch wire at the station to be visited, and a receiving instrument, having a switch or circuit changer, by which the said branch circuits are connected one at a time successively with the receiving instrument.

382,001. Electric Gas Lighter; Chas. W. Holtzer, of Brookline, Mass. Application filed June 22, 1887. A single



382,110. PROTECTOR FOR ELECTRIC LAMP SOCKETS.

vibration in one direction causes the gas to be turned on and ignited instead of the usual double vibration to perform the same work.

382,098. Apparatus for Preparing Secondary Battery Plates; Albert Franklin Madden, Newark, N. J., Assignor to the Electrical Accumulator Company of New York. Application filed Sept. 20, 1887. The plate is fed through the machine between guide rollers, and on its passage the pockets in the plate are filled with the oxide or other excitant material in the form of paste.

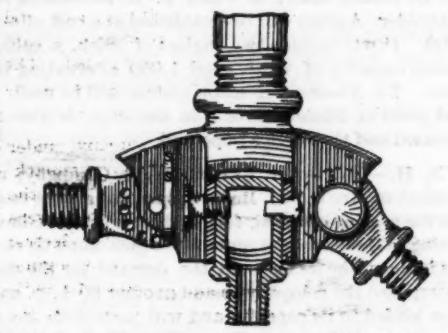
382,110. Protector for Electric Lamp Sockets; Christopher P. Reilly, of New York, N. Y., Assignor of two-thirds to Thomas F. Ryder, of West New Brighton, New York. Application filed March 3, 1888. A covering for electric lamp sockets, which consists of a cap and casing partially surrounding the socket secured together by a moisture-tight joint, and a rubber sleeve connecting the casing and the lamp-globe, making tight joints with each. See illustration.

382,112. Automatic Switch for Secondary Batteries; John S. Sellon, of Hatton Gardens, County of Middlesex, England, Assignor to the Electrical Accumulator Co., of New York. Application filed Aug. 30, 1887. Patented in England Jan. 13, 1883, No. 217; in France, June 20, 1883, No. 156,156; and in Germany, June 17, 1883, No. 27,868. Gas generated by the decomposition of the electrolytic liquid controls a device for opening and closing the circuit of a magnet which is adapted to operate a switch for throwing the battery onto a charging circuit or a working circuit.

382,150. Process of Bleaching; Eugene Hermite, Paris, France. Application filed Feb. 11, 1885. Patented in France Sept. 11, 1884, No. 164,230; in Belgium, Sept. 13, 1884, No. 66,300; in England, Oct. 21, 1884, No. 13,929; in Italy, Oct. 23, 1884, No. 17,506; in Germany, Oct. 24, 1884, No. 35,549; in Sweden, Jan. 10, 1885; in Spain, Feb. 28, 1885, No. 6,537; in Norway, May 19, 1885, and in Austria-Hungary, Jan. 5, 1886, No. 35,217. The process consists in electrolyzing a solution of chloride of magnesium, and subjecting the material to be bleached to the action of the solution.

382,165. Automatic Temperature Regulator; Warren S. Johnson, of Milwaukee, Wis. Application filed June 23, 1887. A thermostat operates directly upon a motor to trip the same into or out of operation. The rotation of one of the motor shafts controls two circuits, one of which opens a compressed air supply and the other closes the same. The circuits are closed in rotation.

382,174. Armature for Dynamo-Electric Machines; Robb Mackie, of Troy, N. Y., Assignor to John B. Tibbitts,



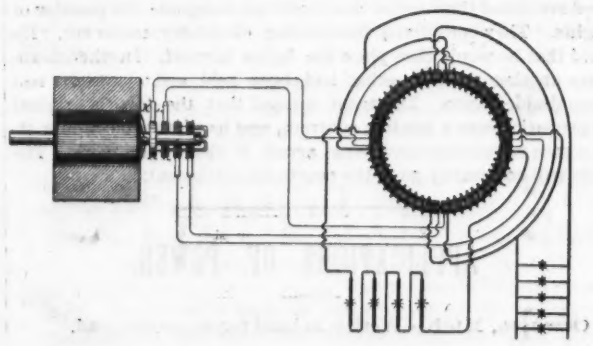
381,921. ADJUSTABLE NIPPLE FOR INCANDESCENT ELECTRIC LAMPS.

of same place. Application filed May 9, 1887. A disc armature having its coils wound in the plane of rotation, the cores of which coils are composed of iron plates arranged in substantially radial lines, whereby the magnetic density is greatest at the part of the core nearest the axis of the armature. See illustration.

382,183. Apparatus for Producing Metals by means of Electrolysis; Johannes Omholt, of Gössnitz, Saxe-Altenberg, Germany, Assignor to Chemische Fabrik Gössnitz, Bottiger Seidler, of same place. Application filed Feb. 17, 1886. Patented in Germany, June 6, 1885, No. 34,278; in France, June 15, 1885, No. 169,562; in Belgium, June 16, 1885, No. 69,294, and in England, June 19, 1885. For producing aluminum and such metals, a fire-box and a reverberatory furnace with half retorts in the reveratory chamber, electrodes in the half retorts, a compartment below each half retort, a tube establishing communication between each half retort and its compartment, and a detachable cap or headpiece on the outer end of each compartment.

382,195. Telegraph Receiver; Charles Selden, of Baltimore, Md. Application filed Nov. 15, 1887. This invention belongs to the class of receivers known as "harmonic," and utilizes the tuning fork. The fork is vibrated by a magnet directly in the main line, and the contacts are so placed and adjusted with reference to it that the fork will only respond to impulses of a certain rate. It will thus be seen that a great number of forks may be placed in a single line over which are sent varying series of impulses.

382,231. Electric Igniting Apparatus; Leon Hen and Rodolphe Weinmann, of Brussels, Belgium. Application filed Feb. 7, 1888. Patented in Belgium Jan. 5, 1888, No. 59,593, and in England Jan. 19, 1888, No. 873. A lamp casing is in contact with one terminal of a generator, and a contact brush forms the other terminal. When the lamp is withdrawn from



381,970. SYSTEM OF ELECTRICAL DISTRIBUTION.

its casing the brush makes contact with the wick tube, producing sparks which ignite the wick.

382,249. Automatic Electric Gas Burner; Elmer E. Bailey, West Everett, Assignor of one-half to Wm. Sears, Malden, Mass. Application filed Nov. 9, 1887. Structural details whereby the gas is turned on and ignited by the use of a single wire.

382,253. Fire Alarm Signal Circuit; Wm. Carroll, of Chicago, Ill., Assignor to John P. Barrett, of same place. Application filed Feb. 6, 1888. An arrangement of circuits and relays whereby the door-opener at fire alarm station houses is operated automatically at the proper time. The invention is designed as an improvement on the Barrett system.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.